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The "Nebraska" steaming in division during maneuvers. The flagship has just turned eight points to port. In the foreground are the bridge and the superstructure with three of the twelve 3-inch guns. Below is the fore deck.

OUR FIRST LINE OF DEFENSE—A BATTLESHIP DIVISION IN MANEUVERS.—[See page 328.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Patent "Evils"

THREE so-called "evils" have been made the target of those who are responsible for the attempts to restrict the enjoyment of those exclusive rights which the inventor of a useful article or machine now enjoys under the Constitution.

First of all there is the "evil" of fixing the price at which a patented article is to be resold to the public. Patent-law reformers apparently fail to realize that no one is compelled to buy a patented article. If you object to paying $5 for a safety razor, you are at perfect liberty to use the old-fashioned naked blade. You are not deprived of anything that you enjoyed before. Surely there is here a fundamental difference between the monopoly which controls a necessity of life and fixes the price at which it may be sold; and surely the framers of the Constitution were right when they endeavored to encourage inventions by granting for a limited period a monopoly which often meant increased riches for the country.

The same argument applies to the "evils" supposed to arise when the vendor of a patented article prohibits its use, except in connection with other unpatented articles purchased from him. The history of one invention of which we know sheds much light on the practice. That invention is a duplicating machine which is now to be found in almost every well-equipped business office. The first attempts to introduce it were discouraging. It was offered to bank presidents and merchants at a price which represented but a small increase over its cost of manufacture—in other words a reasonable profit. Despite the merits of the machine, office managers would have none of it. Then it was that the patentee hit upon the idea of selling his machine at a little less than cost, with the understanding that he was to supply the stationery, the inks, and the supplies necessary to make duplicates by the machine. The effect was magical. Every one wanted to use the machine at the new low price. No one seemed to care that the manufacturer was deriving a far greater revenue from the profit on supplies, however reasonable that profit was, than he would possibly have earned had he succeeded in selling his machine at the original price and left to the purchaser the privilege of buying supplies wherever he could. Here we have an instance in which business strategy of a high order was required in order to introduce an invention which measurably increased the amount of business that could be handled with a small office force.

The third "evil" of which we hear much, is that of suppressing patents or prohibiting their use in order to prevent competition with other patented or unpatented articles sold by the owners of the patents. Not a single instance has come to our notice of wilful suppression. The telephone company, the manufacturers of type-setting and type-casting machinery, makers of typewriters and machine tools have taken out hundreds of patents which are not "worked." But in every one of these cases it will be found that the inventions have been developed by the companies themselves. Often as many as ten or even fifteen patents are taken out on as many machines for accomplishing but one result. Of these patents perhaps only one will be "worked," for the simple reason that the machine which it covers is the simplest and most efficient. Despite the fact that the unused patents represent an investment of perhaps $150,000 (not an unusual figure) in discarded inventions Mr. Oldfield would compel the owners of the patents to grant to any one the right to use them—in other words, grant a license which would create a rival who has himself contributed absolutely nothing to the art. Again, it seems to be overlooked that at the end of seventeen years, a patented invention becomes public property; anyone has the right to use or sell it. Even assuming that inventors or their assignees did suppress patents, what injury has the public sustained? It has been deprived of nothing; it has the right to use the invention after the legal monopoly has expired.

After all, Mr. Frederick P. Fish, one of our most eminent patent lawyers, and Mr. Louis D. Brandeis, both broad-minded men, both realizing the necessity of reforming our patent system so that an inventor and the public will be more fully protected, were correct in their views. "The right to accumulate patents," as Mr. Fish remarked, "is one thing; the right of a number of manufacturers who own patents to come together and consolidate is another thing." That important distinction seems to have been overlooked. "To meet this situation wherever or whenever it may exist," said Mr. Brandeis, "what is needed is not a law dealing specifically and in this limited way with patents, but dealing broadly with the situation; which is going to cover not only patents, but is going to cover all articles."

The Lesson of the Naval Review

WHEN the President of the United States, amid the thunder of saluting guns, steamed down the far-flung line of warships at the recent Naval Review at New York, the sight was one which might well bring a thrill of patriotic pride to the hearts of the assembled multitude. Twenty-five years ago, when our new navy had its modest beginnings, scarcely a ship of the vast fleet which has just disbanded was in existence. That we have so powerful a navy to-day is due to the generosity of Congress, especially in the earlier half of the period referred to. That our Navy is so strong in battleships is due to the foresight of our Navy Department in putting the bulk of the displacement of its ships into capital vessels, able to take their place in the first line of battle. To-day the United States barely holds its proper position of second in naval strength among the navies of the world; if indeed we have not lost that position to Germany. Battleships are essentially the guardians of the peace, particularly when they do police duty for a nation so rich in resources as our own. Just now, when the growth of the country in wealth and influence is so rapid, there should be a proportionate increase in the number and power of our fighting ships of the first class. The unfortunate action of Congress during the past year has shown how little this fact is realized. The battleship appropriation was cut in half, and when vessels have reached a displacement of 26,000 to 30,000 tons, the cutting down of the programme by one ship represents an enormous loss of fighting strength. If our Navy 4s to maintain its proper standing, not only will the annual programme of two battleships a year be strictly adhered to, but Congress next year will make good the deficit of this year by an appropriation sufficient to cover the construction of three battleships of the greatest size and power.

The following considerations will show how great is the deficit due to the elimination of one ship. This vessel would in all probability have been an enlarged "Nevada," of 30,000 tons displacement, mounting twelve of the new powerful 14-inch guns, behind armor forty per cent heavier than any carried by the modern ships at the review. Because of her powerful guns, remarkable protection and superior speed, this ship would be more than a match for three ships of the "Connecticut" class, at the great range at which she would elect to fight them.

Seattle and Puget Sound Harbor Improvements

IN the year 1908, when the Atlantic fleet of sixteen battleships steamed into Puget Sound and dropped anchor in crescent formation a short distance from the docks at Seattle, striking evidence was afforded as to the ample depth of water and wide area of anchorage afforded by the harbor. A battleship fully loaded often exceeds a 30-foot draft. An even finer demonstration was afforded when on September 19th last the steamship "Minnesota," the largest cargo carrier on the Pacific, drawing 39 feet 6 inches aft, under her own steam, backed out from her pier, swung into the harbor, and without the assistance of tugs, was soon under full headway for Yokohama, carrying what was probably the largest cargo ever carried by any ship.

These excellent natural advantages of deep and sheltered waters, are to be supplemented by large and costly improvements—the work partly of the United States Government and partly of the public-spirited citizens of Seattle. The part of the latter is represented by a bond issue of $5,000,000, the money to be used for condemnation of one hundred and twelve acres of the highest class industrial property in the city, and the erection thereon by the Port Commission of a series of piers. These facilities are to be leased to a Terminal Company, which will improve the balance of the ground on a plan similar to the Bush Terminal Company, Brooklyn.

So far as actual harbor improvements go, the Government and the people of the Northwest are spending more than $8,000,000 for waterways, jetties and similar work. The largest project is the Lake Washington Canal, extending from Salmon Bay to Union Bay on Lake Washington. The distance is between four and five miles. The channel will be 100 feet wide at the bottom and from Salmon Bay to Lake Union will be 35 feet deep at low tide; from Lake Union to Lake Washington will be 25 feet at low tide. In connection with this waterway, which will be completed the last of 1914, the Government is now at work upon a huge lock, the second largest in the United States, costing $2,275,000. The lock will be 860 feet long and 80 feet wide, inside dimensions. The right-of-way for this canal cost $250,000, the excavation already has cost about $450,000, and the excavation to complete the canal will cost another million, making a total expenditure of about $4,000,000 for this waterway.

The great value to Seattle of this canal, opening up, as it does, two great fresh water harbors, supplying generous dock space and factory sites, is evident. It increases the water frontage from 14 to 150 miles. The Government stands a little over one half of the expenditure, the people of Seattle and King County the balance.

Another waterway project contemplated, is the straightening of the Duwamish River. This plan involves an expenditure by the people of that district of about $1,000,000 to construct a straight channel in place of the serpentine Duwamish River, extending south four miles from the harbor. This channel, which will be 18 feet deep, will open up a river front industrial tract now supplied with only railroad transportation.

Other improvements in the Northwest being built by the Government are the Gray's Harbor jetties, costing in all about $2,600,000. The jetty on the south side of the harbor, 14,000 feet long, is completed and of the one on the north side about 13,000 feet is partially completed, and will cost when completed $1,600,000. These jetties are for the purpose of scouring out a bar at the entrance of Gray's Harbor. Seattle, fortunately, has no problem of a bar to contend with.

The Government is also installing training dikes at Everett Harbor and at the mouth of the Snohomish River. These are about three miles long and cost $125,000. The cost of dredging about 600,000 yards of dirt for the channel will cost approximately $80,000 additional. At Bellingham a waterway is being dredged at a cost of about $100,000, involving 600,000 yards of earth. At Willipa Harbor an 18-foot channel is being dredged from the Bay to Raymond, between seven and eight miles, involving the removal of 1,500,000 yards of dirt, and at a cost of $115,000. At Olympia, a waterway on the west side of the harbor is being widened from 100 to 200 feet at a cost of $40,000. The Port Commission has a scheme of dock improvements involving four or five municipal docks, including a large timber dock for the handling of the timber shipments of the entire Puget Sound country.

Exposition Relating to Accident Prevention

A PERMANENT exposition, which should be of interest to inventors, has been opened in Copenhagen and has for an object to exhibit the latest devices and measures to prevent accidents and injuries to workmen. It is projected by the Danish Association for the Protection of Workmen, and is aided by the factories and firms furnishing the apparatus. It contains exhibits looking to the prevention of accidents by power raising, transmission, and working machines, as well as measures looking to the carrying through of regulations relating to factories; also statistics and literature. It includes an exhibition of water gages illustrating measures to be taken in attending steam boilers, and an instructive collection for the enlightenment of the worker on dangers incident to steam boilers. The protection of workmen consists not only in means for protecting them from mechanical injury, but also the improvement of conditions generally looking to their health, such as a sanitary condition of the premises, ventilation, insurance against accident and illness, and it is the intention to change the exhibits from time to time so that they will illustrate advancements which may be made toward the end in view.

Electricity

Electric Heating for Outdoor Comfort.—Policemen of the traffic squad, stationed at street intersections all day long in wintry weather, are coming in for consideration of their comfort in Indianapolis. That city has appropriated $700 for installing at twelve downtown street crossings a small steam-heated "manhole," on which the traffic policemen can stand to keep his feet warm.

Electricity in the Textile Industry.—A large percentage of the output of the textile industries in France comes from domestic workshops, and at Lyons alone there are thousands of workmen thus employed. Electric motors are coming into use extensively, and are well adapted for this purpose, and on this account there is a tendency to abandon large works in favor of domestic plants. In the Isere region where large factories were the rule up to 1890, there are being installed small shops in the villages which are run by electric motors.

Eiffel Time Signals in Switzerland.—The time signals sent from the Eiffel Tower are received not only in France but also in Switzerland, where a number of receiving posts are being set up for the purpose. This is especially true in the watch-making district where the time signals are useful. The steeple of the Payerne church serves for a post which M. Blankart has installed, and he uses wires 85 feet long stretched from the top of the spire to four points below. He is able to receive the signals from Paris at a distance of 270 miles with a very simple wireless apparatus.

Electrical Christmas Gifts.—Electricity contributes a surprising number of gift articles for serious use, for convenience and for amusement—a considerable increase for the holiday season of 1912. A recently published list comprises over 125 of such special articles in which small amounts of electric current are transformed into light, heat or power, the varying applications showing the extent to which electricity has entered home life. Electric heating and cooking devices and appliances for saving labor in the household head a list of "gifts for women." Then there are about thirty electrical toys for children, appealing mainly to boys, of course. Over twenty other articles suitable for men are made, and almost as many again for bedroom and nursery comfort.

The Giant Condensers Required for Steam Turbine Generators.—The importance of the condenser to the efficient operation of the high-capacity steam turbine generators which are now so generally used in large electric central stations is well illustrated by the new apparatus in Chicago's latest electric generating station, the "Northwest Plant," designed for an ultimate equipment of 240,000 kilowatts. In the turbine room there are installed at present two 20,000-kilowatt vertical units, and the turbine-base condenser of each unit contains 7,500 one-inch brass tubes 17 feet long. The total effective condensing surface of 32,000 square feet thus provided is designed to maintain a two-inch vacuum when condensing 280,000 pounds of steam per hour. The main condenser shell weighs 141,000 pounds.

Color Decorative Lighting at the Boston Electrical Show.—The electric light decoration for the exterior of the Mechanics' Building, Boston, where the Electrical Show opened on September 28th, includes some novel and beautiful features carried out under difficulties. The walls of this building are covered with ivy (the growth of many years) which could not be disturbed, so the special decorative effects obtained by incandescent lamps are supported on falsework extending to the ground. These effects include mosaics of conventionalized flowers and foliage, in 4 and 8 candle-power lamps with dark red, light red, amber, dark green and light green bulbs. In addition, a number of decorative lampposts bearing flame are lamps in groups of four are used, the group comprising a single pale-green lamp above and three pale rose-red lamps below. Pairs of pylons at the two ends of the street on which the building stands carried thirteen flame are lamps each, the lamps in the two upper tiers being pale-green and the remainder rose-pink.

The Incandescent Lamp in New York Thirty Years Ago.—The New York Electrical Exposition held October 9th to 19th emphasizes the historical side of the electrical industry, especially the vast development of the public incandescent electric lighting service in New York city. This service to-day—well over 5 million actual lamps aggregating about 10¾ million 50-watt equivalents served from two gigantic central stations and 31 substations over 1,292 miles of underground mains and feeders—is the outgrowth from the original Pearl Street station, where the current was first switched on at 3 P. M. September 4th, 1882. Of the six "Jumbo" 125 horse-power dynamos which in that "day of small things" served 400 lamps, distributed among 59 customers, all but one was destroyed by fire in January, 1890. The one dynamo that was saved is now treasured as a relic; its work is done to-day largely by steam turbine generators of capacities up to 30,000 horse-power in a single unit. This original machine will be brought to the exposition from its honored retirement, and a model of the original central station will also be shown.

Science

Passing Gases Through Iron.—It has been known for some time that gases will pass through metals when they are highly heated, thus platinum at a red heat will allow air to pass through it. Iron is also permeable for hydrogen when hot and even when cold to a certain degree. More recently, Charpy and Bonnerot show that nitrogen does not penetrate iron below a temperature of 800 deg. Cent. Hydrogen passes more easily, and at a temperature of 500 degrees a considerable action is noticed.

New Monetary Standard.—At the Science Congress held at Nimes, France, a report made by M. Gobin was adopted, namely that a monetary standard be used by all countries which is adapted to the values now in use. The unit is known as the "mono" and has the value of $0.05. It corresponds to the well-known monetary units as follows: Franc, 4 monos; mark, 5 monos; florin, 8 monos; shilling, 5 monos; piastre, 10 monos; yen, 10 monos; lire, 4 monos; peseta, 4 monos. The dollar would correspond to 20 monos.

Prof. Lewis Boss, Professor of Astronomy in Union College and Director of the Dudley Observatory, Albany, died at his home in Albany at the age of 66. Prof. Boss was director of the Dudley Observatory for thirty-six years. Prior to that, from 1872 to 1876, he was the astronomer of the Northern Boundary Commission. He headed the United States Government expedition to Chile, in 1882, to observe the transit of Venus. Recently he has been director of the Department of Meridian Astronomy in the Carnegie Institution. He was a member of the National Academy of Science and foreign associate of the Royal Astronomical Society.

The Care of Books.—Persons about to install new libraries, or those who find their books in bad condition, will be glad of the advice offered on this subject by a writer in *Les Annales* (Paris). Glass cases should always be avoided, except for a few precious volumes which are specially looked after and frequently dusted, since the confined atmosphere and lack of air-circulation in such bookcases is favorable to the development of germs, insects, and mold. Secondly, the simple precaution should be taken of placing on the shelves behind the books strips of cloth or flannel moistened with benzine, phenol, tobacco juice or turpentine. These strips give excellent results if renewed from time to time.

Infantile Paralysis Spread by Stable Fly.—Infantile paralysis is transmitted by the stable fly is the important discovery which Dr. M. J. Rosenau, professor of preventive medicine and hygiene at Harvard, announced to the fifteenth International Congress of Hygiene and Demography. Dr. Rosenau experimented with monkeys, the animals most closely resembling man. Twelve monkeys were infected with infantile paralysis. At different stages of the illness a large number of stable flies were introduced into the closely screened cages containing the monkeys. The stable fly bites. After a certain period the stable flies were transferred to cages containing well monkeys. These animals after being bitten by the flies developed all the symptoms of infantile paralysis, just as they appear in children afflicted with the disease. Some of the monkeys died. Dr. Rosenau took tissues from the monkeys thus infected by the flies and injected them into a third set of monkeys, which thereupon developed the disease. A method for eradication and control of infantile paralysis is now placed in the hands of sanitarians. It is believed that the necessity of quarantine is thus relieved, and that it will suffice to place a bed net around the patient.

A Kinematographic Study of Street Conditions.—At the Cities Exposition held recently in Duesseldorf, Germany, the perils of street traffic were illustrated in a convincing manner by means of kinematographic pictures made by the Duesseldorf Street Railway Company. Everybody knows that it is dangerous to board or to alight from a moving car. Statistics show that nearly fifty per cent of all street railway casualties are due to this foolish practice. One film showed a woman alighting from a slowly-moving car in the usual careless manner and coming to grief in consequence. In contrast was exhibited a film bearing the device "The Left Hand on the Left Handle" and showing a woman alighting properly and safely. A third film illustrates the danger which a person walking, driving or cycling behind a car incurs by shifting to the other track without assuring himself that his new course is clear. The film shows a bicyclist turning to the left from behind a car and colliding with an automobile moving in the opposite direction. Another film illustrates the notorious bad habit of truckmen and hackmen, who persist in obstructing the tracks in defiance of the warning gongs and whistles of overtaking trolley cars. This obstructive policy of drivers should be combated by energetic measures. It is intolerable and absurd that thousands of persons should be delayed daily in this age of haste by the selfish obstinacy of a few drivers. The time-saving and other advantages of the new type of street car, in which the exit is separate from the entrance, are also shown by comparative kinematographic studies.

Automobile

Special Cars for Hunting Dogs.—Owners of large estates in England have purchased a new style of motor truck, which is especially designed for the transportation of hunting dogs to and from the rendezvous. One of these trucks will carry ten dogs, each in a separate little "stall."

A Gasoline Tank for Automobiles.—Howard E. Coffin, the well-known automobile inventor of Detroit, Mich., has secured a patent, No. 1,039,098, for a tank which has a hollow partition dividing it into compartments, and the tank is provided with means which will indicate any leakage from either compartment into the hollow partition.

Number of Cars in Germany.—According to statistics just issued by the German government, there are at present 43,000 passenger cars, 7,000 motor trucks and 20,000 motorcycles running on German roads. This is considerably less than in half a dozen American States, and barely half of the number in use in New York State alone.

Venezuela Opens Automobile Line.—The Minister of Public Works at Caracas has granted a franchise to some promoters who are planning to run an automobile 'bus line from Valencia to Nirgua. The cars, which will be used for both passenger and merchandise transportation, are to be admitted free of duty. Active operation is to begin at once.

A Yielding Tire Filler.—There appears to be considerable interest in the provision of yielding fillers for tubular rubber tires. William Edgar Howser and Albert M. Woltz of Greensboro, N. C., have patented, No. 1,038,891, a tire filler which consists of pulverized cork, sulphur and corn oil with the proportion of corn oil about three fourths of the entire composition.

Blow-out is "Higher Power."—French courts have just decided that when an automobile tire "bursts" it is the influence of a "higher power," in the sense of the French law, which frees the perpetrator of any injury from responsibility for damages caused. A touring car "blew" a tire, and crashed into a store window. A lawsuit followed, and the storekeeper lost, because the "higher power" clause was applied.

Berlin Forbids Chauffeurs to Smoke.—Declaring that the habit of smoking cigarettes or cigars, while in charge of an automobile, was responsible for many accidents, the municipal authorities of the city of Berlin, Germany, have forbidden chauffeurs to smoke while on duty. The order applies not only to all chauffeurs driving taxicabs but also to anybody, whether prince or peasant, who sits at the steering wheel of a motor car. The rule has caused extraordinary excitement, but it is enforced with impartial severity.

Intercity 'Buses for Canada.—As it would not pay in many of the provinces of Canada to build railroads for the present comparatively small traffic, it is planned to establish in all parts of the country automobile 'bus lines, connecting the various cities and villages. For this purpose a $10,000,0000 company, called the Canadian Autobus Company, has been formed and a large number of 'buses are to be installed at once. One million dollars are to be spent in Montreal alone, and other cities are to get proportionate amounts.

French Courts are Strict.—How important the proper observance of traffic rules seems to the French is best shown in the decision of the highest French court in the case of a motor truck which was not properly lighted in the rear. A passenger automobile ran into the truck on a dark night, and the negligent driver of the truck was sentenced to imprisonment, to pay the damages to the passenger car, to pay for injuries received by the chauffeur and, finally, to reimburse the owner of the passenger automobile for the inconvenience caused by the loss of the use of the car.

Nitroglycerine to Drive Automobiles.—Every now and then somebody comes out with a staggering proposition to increase the power of automobiles. The latest plan, thought out by a Houston (Texas) man, provides for the use of nitroglycerine as a power producer. The explosive has been used before in schemes like this, usually to the great sorrow of the relatives of the inventor, but the latest nitroglycerine motor is not designed for pure explosive, but for a solution of it in gasoline. The inventor admits that his motor needs more "development" but is sure of "ultimate success."

Belgian Automobile Show.—The Twelfth Belgian Automobile Show is to be held at Brussels in the Cinquantenaire Palace from the 11th to the 22nd of January next. The exposition is an international one, and there are ten general classes of exhibits, automobiles and chassis complete; motors and accessories; tires; carriage work; power wagons including either heavy or light weight cars for handling all kinds of freight. The other classes include stationary motors or groups, machine tools, agricultural automobiles, aeronautics and the like. It is expected that the show will bring out a large number of exhibits.

Four-room, two-story frame houses erected by the Indiana Steel Company for employees in Gary.

Tinplate Company's detached house of solid concrete exterior.

Concrete Houses Versus Tenements

Model Dwellings for Workingmen

By Marc N. Goodnow

ELEVEN New York city blocks have a density of 1,200 people per acre, which means that if the whole of little Delaware were similarly crowded, it could contain the entire population of the world, white, black, yellow and red. This almost inconceivable city congestion means, further, that these people must live in tenements, where they are compelled to stunt and warp their own and their children's lives to fit the space requirements of their foul surroundings.

Many cities smaller than New York can boast of congestion among their sweated or factory workers, which though not so great in density is none the less inexcusable in the light of the greater space over which these cities might easily spread. Where cities have grown up about large industries under the misguidance of real estate speculators, housing conditions generally are distinctly bad. Where the industry itself has had foresight enough to prevent crowding or capital enough to build houses for its employees, some effort has been made to get away from this state of human congestion.

An example of the use of concrete as a weapon with which to exterminate the evils of crowded housing and city congestion is furnished at Gary, Indiana, where the American Sheet and Tinplate Company is completing fourteen buildings of monolithic concrete, costing something over $130,000, and furnishing apartments and houses for seventy-four families of workmen in its local mills. These are the beginning of a group or settlement of houses planned to accommodate eventually from 250 to 350 workmen's families.

By improving upon former methods of pouring concrete into wooden or metal forms, the company has gone a long way in solving a knotty problem—that of housing employees in inexpensive yet durable houses which can be grouped together in an attractive manner, and low enough in cost for these same employees one day to buy. The same design was carried out in the same community by the United States Steel Corporation, which erected frame houses and afterward disposed of many of them to employees on the monthly payment plan.

Estimating the cost of the finished apartments and houses at $133,000, that of a single dwelling would figure as low as $1,803, which, in Gary at least, is a comparatively low sum. The detached houses, of course, would approximate at least $2,750 each, and more in a number of instances. But tinplate employees average a higher wage than steel mill employees, and their purchasing power, consequently, is somewhat larger.

The present investment of the tinplate company stands at close to $200,000 for equipment, forms, materials and labor. Its forms cost approximately $40,000, and have been used in the construction of the following houses and apartments:

Six houses at $2,750 each	$16,500
Three ten-apartment houses	49,000
Two ten-apartment houses	32,500
Two four-apartment houses	13,000
One three-story ten-apartment house	22,000
Total cost	$133,000

These buildings are provided with all modern conveniences and sanitary essentials. Mantelpieces and buffets are made of concrete, as well as water pipes, drains and gutters. The detached houses, two stories in height, are provided with shower baths. The floors are of concrete, wood or composition. The roofs are composed of tile or gravel and tar.

The exterior ornamentation also is formed of solid concrete. In fact, every feature of a house which can be built of indestructible material is so constructed. A variety of architecture which is not unpleasant to the eye has been secured, and the settlement is far more attractive than long rows of tenement houses. The "ten-terrace" houses, with accommodations for ten families, are a departure from the set rule of workmen's cottages. They follow more closely the style of the Philadelphia house, and in Gary contain seven rooms, four on the first floor and three on the second. In the three-story terrace houses, each apartment has nine rooms.

The Edison plan for monolithic concrete construction—that of large molds of steel into which the liquid stone is poured—has been improved upon in the newer "sectional" forms used by the tinplate company. These sectional forms and their accessories in the process of "setting up" number 28,000 separate pieces and comprise the equipment for as many as twenty different styles of house, each varying in architecture. The frames or sections are composed of durable sheet steel and constructed with flanges which can be clamped together to form a continuous wall or floor. With the foundation section in place a force of workmen sets each section on top of the previous one until the required height of the first wall has been reached. Each floor becomes a separate entity: in fact, each room is an entity, surrounded completely by concrete reinforced with bars of steel or mesh wire. The interior and exterior surfaces are later smoothed and pointed, then painted, calcimined, plastered, sand-blasted or tinted, according to the plan of the architect, and the artistic effect he desires to produce.

These houses and apartments are built to rent for from $12 and $15 to $25 and $30 a month. They are within walking distance of the company's

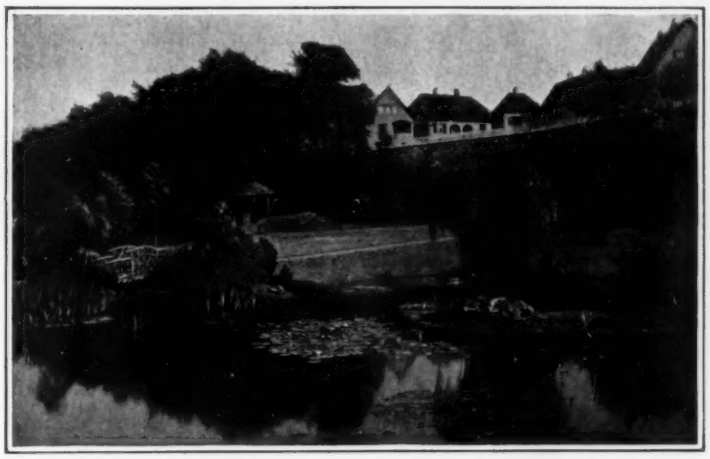
Kirk settlement-houses erected by the Elgin, Joliet & Eastern Railroad for its employees at Gary.

Five two-apartment buildings facing the ten-terrace house.

plant and are placed south of the smoke which comes from the plant. There are about these houses ample yard space, garden plots, fresh air and sunshine. Their occupants are not cooped up on a single floor with no breathing area and no sanitary provisions. There are porches for summer social advantages and play room for the children. These concrete houses are in strange contrast to the flat-congestion which prevails on Gary's south side among the poorer working classes. There it is not unusual to come upon forty people living and sleeping in a six-room flat. The new houses, in fact, are in strange contrast to the cheaper grade of houses erected by the corporation for its steel mill employees and known as "Hunky Row." These frame houses soon became a fester in the city for crime and immorality, and have finally been abandoned by the corporation. They are to be replaced by a better class of houses, probably of concrete.

Of course, there is one big objection to houses of this kind under the present conditions. The man and family who really need such advantages most are the ones who in a great majority of cases cannot afford to pay the price. Further than that, there is very often a class distinction which makes itself painfully apparent on occasion, and the day laborer often prefers to remain among his own kind. By constructing houses for the different grades of workmen (the basis being their salaries) on the same streets, the steel corporation overcame a large measure of this purely fictitious valuation. In a number of instances it was found that the day laborer "sandwiched" in between two foremen or superintendents was benefited greatly by thriftier examples ahead of him. The tinplate company is endeavoring to do the same thing in its houses and their location.

While we must commend the policy which has governed the building of these workingmen's dwellings, we cannot refrain from pointing out how much better these things are done in Germany, at least from an artistic point of view. The German town of Essen may be compared with the American town of Gary; for at Essen the enormous cast steel works of Krupp are located. The Krupps first began to build workingmen's dwellings in 1861. At first, tenement houses were erected, but in 1894 (in Alfredshof) the cottage system was adopted. So far as external appearances are concerned, there can be no doubt that these Krupp cottages are far more attractive than the houses at Gary. Between 1871 and 1874, over six million marks ($1,430,000) were spent by Alfred Krupp to provide housing for 2,400 families. The architectural efforts of that period in Essen were no more creditable than those at Gary. It was not until the Krupp works began to develop rapidly during the nineties of the last century under the directorship of the late F. A. Krupp, that the problem had to be attacked anew. In old Alfred Krupp's day, the chief problem to be considered was that of providing cheap dwellings, so that even the poorest workingman might have a chance to save money. When F. A. Krupp assumed the directorship, it became a serious matter to provide adequate dwellings for hundreds of families. There were no adequate accommodations in Essen. They had to be created. This he did, from a utilitarian as well as from an æsthetic point of view. Twenty minutes southwest of the cast steel factory of Essen lies his colony of Alfredshof. It was built between 1894 and 1899, and comprises about two hundred and fifty structures for one, two, three, and four families. Each house lies in the midst of a small garden; each has a small veranda. Although the Krupps were compelled to abandon the cottage system because Alfredshof could not be further extended, and because the town of Essen had grown so rapidly that real estate became very costly, the idea of housing workingmen in attractive dwellings was not abandoned. It was necessary to return to the tenement system, but to tenements designed with such good taste and provided with such admirable sanitary arrangements that it is hard to believe that they are intended for the moderately paid workingmen of a cast steel works.



A glimpse of the workingmen's colony at the Krupp cast steel works at Essen.

Modern tenement houses of the Krupp workingmen's colony.

Preparing to set forms on the basement floor.

Source of Commercial Divi Divi

DIVI DIVI is the trade name for the seed pods of a small leguminous tree botanically known as *Cæsalpina coriaria* Willd., a native of tropical America and the West Indies. Its natural range has been increased both to the north and south by planting. It grows sparingly in southern Mexico, but it is more abundant throughout Central America, Colombia, Guianas, Venezuela, and the northern part of Brazil. Under favorable conditions of growth it attains a height of from 15 to 30 feet and produces an immense number of small yellow flowers which resemble those of the laburnum tree (*Cytisus laburnum* Linn.), which is planted frequently for ornament in this country. These flowers are soon followed by dark glossy-brown pods, which vary from one to three inches in length and are about two thirds of an inch in width. These pods, which are at first straight, soon curve or bend like the letter C, but when they are fully matured they curve like the letter S. They are filled with a yellowish powdery substance and with a few dark-colored seeds. The seeds have no commercial value, but the yellowish powder contains as much as 50 per cent of tannin, which causes it to be used extensively for tanning purposes. The tannin derived from these pods differs materially from that obtained from oak bark or galls. It is said that one part of divi divi is sufficient for tanning as much leather as four parts of that from oak bark and the process occupies only about one third of the time. Tanners seldom use divi divi tannin by itself, but they generally mix it with oak bark and valonia (acorn cups of *Quercus ægilops* Linn.). Leather produced by this means is used principally for soles.

The divi divi tree has recently been introduced into other tropical countries, but only to a small extent. In the East Indies its cultivation has been most extensive and successful. Although divi divi is produced naturally in enormous quantities, a need has been felt for artificial propagation of this tree, especially in regions where it is not native. Divi divi is at present grown for commercial purposes in Java, Ceylon, India, German East Africa, and other parts of tropical Africa. It is also cultivated on a small scale in the West Indies, especially in Jamaica. The cultivation of this tree is simple, and the yield is often very large. Since the demand for divi divi is so great, it seems advisable to recommend its planting in all countries that have soil and climatic conditions in which this tree admits of being cultivated. That it can be grown profitably on a large scale in the American tropics simply for the sake of its pods is doubtful, on account of the lack of efficient labor. It can be cultivated, however, as a minor crop in a banana, sisal, or cocoanut plantation. It is also an excellent tree for shade or for wind break.

An experimental plantation was made in Dar-es-Salem, German East Africa, in 1901, and the first crop from these trees showed that the results were entirely successful. An experienced planter from tropical Africa writes that divi divi in German East Africa thrives from sea level to 2,500 feet elevation. It begins to bear in the fifth or sixth year, depending upon the character of the soil and climate, and retains its capacity for production up to the twenty-fifth year. A thrifty tree is said to produce a quantity of pods valued at about $3.25. The amount of pods produced annually by a full grown tree is about 100 pounds; by deducting 25 pounds for seeds and refuse matter, 75 pounds of good tanning material are left.

Divi divi is reproduced wholly by seed. A seed bed is prepared by mixing with the soil thoroughly rotted manure in the proportion of 2 to 1. The seeds are then placed 8 inches apart each way and about 3 inches deep. The bed must be properly shaded, at least during the hottest part of the day, and the soil must be kept constantly moist. In about ten days the young seedlings will appear above ground, and when they are about 4 or 5 inches high, shading may be discontinued. Nor will it be necessary to water the seedlings regularly every day unless the weather is very hot and dry. When the young trees are about a foot high they are carefully transplanted in their permanent places. The young trees are set 12 feet apart each way. In case the transplanting is done during very dry weather it will be necessary to water the plants daily until they all have taken root and are thriftily growing. They must be partly shaded during the first three months. The care required thereafter consists simply in keeping down weeds until the trees thoroughly shade the ground, which is about the time when they begin to bear fruit.

The pods are picked off when they are deep brown, dried thoroughly in the sun and packed in bags for shipment. The principal countries from which the American tanners derive divi divi are Colombia and Venezuela. Although small amounts are grown in the Guianas, Brazil, and in parts of Central America, it is not imported into this country.

The Barocyclonometer

By C. F. Talman

THE dreaded hurricanes of the West Indies are about to become a more important factor in nautical affairs than they have ever been before, in view of the diversion of trade routes to the Caribbean Sea which is to follow the opening of the Panama Canal. The attention of our Government has been directed to the necessity of a renewed study of these disturbances and the means of protecting vessels from them. The Weather Bureau has now in the press a bulletin on this subject, from the pen of Dr. O. L. Fassig, lately in charge of the meteorological station at San Juan, Porto Rico. Moreover, it is understood that the same Bureau is planning the establishment of several new shore stations in the West Indies, and has already engaged the services of special marine observers aboard vessels in the West Indian trade, who now send twice-daily reports by wireless telegraphy to Washington. Similar considerations have led the Navy Department to adopt for use on the North Atlantic a device called the barocyclonometer, which has proved of great value to mariners in the Far East in determining the proximity of typhoons.

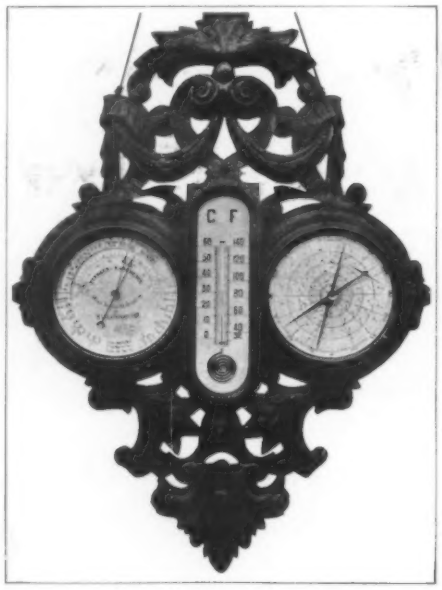
This instrument was invented by the Rev. José Algué, S.J., director of the Philippine Weather Bureau, in 1897. It may be regarded as the outgrowth of several earlier and relatively crude devices for enabling mariners to locate the direction of a neighboring hurricane from local observations, viz., Piddington's horncard, Reid's storm-card, Lloyd's typhodeictor or storm-pointer, Viscovich's cyclonograph, Viñes's cyclonoscope, etc. All of these devices depend upon the fact that the winds around a tropical cyclone have a definite relation to the position and movement of the center, and hence to the state of the barometer.

The barocyclonometer is a signal improvement over its predecessors because it takes account of the fact that the normal barometric pressure—a marked departure from which gives token of a neighboring hurricane—is not the same for all parts of the ocean or for all seasons. It consists of two principal parts, as shown in the accompanying picture, which represents the form of the device now used in the waters of the Philippines and the China Seas. To the left is seen a special form of aneroid barometer. The barometer proper occupies the center of the dial, and is graduated in both metric and English units. Surrounding this is a flat ring of silvered brass which is movable around the barometer dial. The first step in the use of the instrument is to set this ring in accordance with the indications printed on its lower half. For each zone of latitude and for each season there is a definite pressure above which the conditions may be regarded as normal, i. e., if the pressure is above this limit, at the place and time in question, the mariner can be certain that no cyclone exists within a radius of 500 miles. The ring is turned until a red arrow, shown to the left of the segment marked "Variable," points to the reading of the barometer dial corresponding to this normal pressure. If, when the instrument is thus adjusted, the index of the barometer points to a reading to the left of the red arrow, the vessel must lie within a cyclonic area. The segment of the ring marked "typhoon" will then embrace all readings likely to occur within the cyclone. The latter is divided into four concentric zones, *A*, *B*, *C*, and *D*, at various distances from the center of the storm. Having ascertained from the barometer the proximity of a storm, it is of the utmost importance to know in what direction the storm center lies from the ship and the direction in which it is traveling. This is determined by the use of the cyclonometer, shown to the right. The glass face of the cyclonometer is immovable. It is marked at its circumference with the points of the compass and with eight diametrical lines engraved on the glass. Beneath the glass cover is a metal disk which can be revolved by a knob at the center. An arrow passing through the center of this disk (only the point can be seen in the picture, close to the knob) represents the direction of the storm's movement. The other little arrows engraved on the disk show the direction of the winds around the center, as determined by innumerable observations of such storms. These winds have a general right-to-left rotation around the storm, and are also inclined more or less toward the center. The concentric circles seen on the disk mark the limits of the four zones of the storm, *A*, *B*, *C*, and *D*.

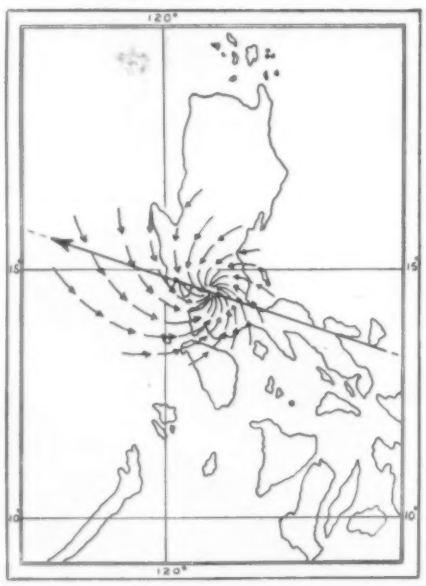
The two long needles pivoted at the central knob and movable about it are called the "graduated needle" and the "double needle." The former has the inner two thirds of one of its halves graduated from 0 to 100; the latter has a smaller needle pivoted at two thirds the distance between the center and one end. Either of the large needles may be used to obtain a first approximation of the direction of the storm center. Having ascertained from the barometer in which zone the ship lies, the disk of the cyclonometer is turned so that the central arrow points in the usual direction of a cyclone's path for the place and season in question; the needle is then set so that one end points to the outer end of the wind arrow most nearly corresponding to the direction of the wind prevailing at the ship, and lying in the appropriate zone. The other end of the arrow will then indicate the cardinal point corresponding to the direction of the storm center from the ship. The use of the second needle involves a somewhat complicated operation, of which space forbids the description here. It is fully explained in Algué's work on "The Cyclones of the Far East."

Several modifications will be made in the instrument to adapt it to the barometric and wind conditions of the North Atlantic.

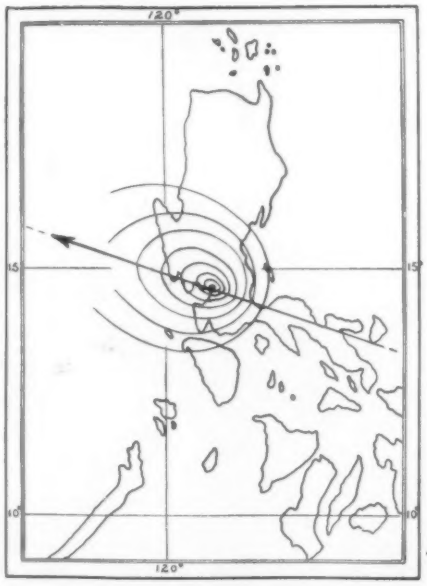
Father José Algué, S.J., director of the Philippine Weather Bureau and inventor of the barocyclonometer.



An instrument that indicates the proximity of typhoons.



Trajectory of the storm and disposition of the isobarometric lines round the vortex.



Convergence of the winds toward the center of the storm.

Solid Oil as a Marine Fuel

THE question of a solid fuel for ocean liners in the shape of solidified petroleum is being taken up of late in Europe, and the outlook for this kind of fuel seems promising. Tests have been made in many countries with spray fuel burners, but when it came to actually applying these on shipboard an obstacle arose, as the new method would lead to a radical transformation of the existing apparatus. Not only are special oil burners needed for the furnaces, as well as regulating appliances, but the devices for loading the liquid combustible on board would need to be changed. Besides, great storage tanks are needed for the liquid, and the action of the latter upon the walls of the tanks would be strongly felt when the vessel is rolling at sea. It was decided quite recently at an important meeting of shipowners at London to go into the production of solidified petroleum brickets on a large scale. These are obtained without any great chemical manipulation. The crude oil is boiled and to it is added a certain amount of stearic acid with an alcoholic solution of caustic soda. Upon cooling, there is obtained a transparent mass somewhat resembling glycerine soap, and it has sufficient cohesion to allow of making it into square-shaped brickets. These are easy to handle, as they are not brittle nor do they cause dust. Such blocks have a slow and very regular combustion owing to their unformity of structure. The weather does not seem to affect them, and they always remain clear. Even boiling water is said to have no effect on the brickets. The heat production from them is such that a ton of solidified petroleum serves instead of 2½ tons of coal. The great saving of space on shipboard is evident, and another point is the great all-around economy realized for producing an equal amount of steam. Some British naval engineers studied the question and concluded that for a single trip of a Cunard liner from England to New York and return the lowest figure for the saving would be $60,000. They also reported the following points in favor of the new fuel: 1. No appreciable modification of the furnaces or bunkers is needed. 2. The brickets burn very well in open furnaces. 3. They have a very high calorific power. 4. No inflammable gas is given off under the action of heat in the furnace. 5. They burn slowly without running of liquid, nor is there any crackling or explosion. No ash is left. 6. Their regular shape facilitates storing, and there is no space lost. 7. The brickets harden with time and reach a great crushing resistance. 8. The range of the vessel will be much increased, which is a capital point for war vessels. From another point of view, it is held that the navigation companies will be more inclined to increase the speed of the ocean liners, since they are able to obtain high steam pressure at a much less cost for fuel than before. On the whole, the new method appears to be a promising one, and a great success is predicted for the solidified petroleum owing to its low price, and its adoption may prove to be rapid in the near future, for liquid petroleum would only be able to replace coal in a gradual way, owing to the great cost of changing over furnaces and bunkers.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Peck's Death Not Due to Gyroscopic Action

To the Editor of the SCIENTIFIC AMERICAN:

Mr. Brooke's arguments on Paul Peck's fatal flight, which appeared in the SCIENTIFIC AMERICAN of September 28th, 1912, are based on false premises.

Mr. Simmons, the builder of the aeroplane, and myself were present and watched Peck, and we observed that before he began his spiral dip *he shut off the motor* (as he always did before volplaning) and consequently no gyroscopic action could have developed during all the time he came down.

If Mr. Brooke wishes to take a stand against revolving-cylinder motors, let him at least stick to facts and not stimulate his imagination into twisted arguments and fallacious conclusions. R. S. MOORE.

Washington, D. C.

The Columbia River Jetties

To the Editor of the SCIENTIFIC AMERICAN:

J. F. McIndoe, Major, Corps of Engineers, U. S. A., makes the following statement *in re* south jetty, mouth of Columbia River, in SCIENTIFIC AMERICAN of October 5th, 1912: "It is confidently expected that it will be completed in the early spring of 1913 and that its maintenance will not require the dumping of more than a small amount of rock in the next few years, while the trestle remains serviceable," etc.

In the annual report of the Chief of Engineers, U.S.A., dated October 14th, 1911, Major McIndoe says: "The revised estimate, approved April 17th, 1909, for the completion of the south jetty was $3,529,300, and is based on a report made by the district officers, recommending that the jetty enrockment be raised to at least mean tide level, and that its crest be given a width of not less than 25 feet, in order to protect the trestle piling from early destruction by storms and teredo. The increased cost is due to the greater amount of stone required, the increased cost of materials, and the heavy loss during construction in previous years, due to destruction of the trestle by winter storms and teredo. In some places the jetty is being built in depths as great as 39 feet, and with 15 feet increase in the width of its crest, it becomes at once evident that an enormous increase in the amount of rock is required. . . . The life of the trestle is very uncertain, and the work of reinforcing the rock must be done before the trestle becomes unserviceable. . . . Amount required for expenditure in fiscal year ending June 30th, 1913, $1,000,000."

Major McIndoe, of course, has the right to revise in September, 1912, what he wrote in October, 1911. It is a habit with Government engineers to make such revisions periodically, and no doubt the next Congress will be officially informed that the south jetty is completed, and that instead of requiring nearly four million dollars more, not another cent will be needed. Major McIndoe, however, must not blame publicists for using the data he presents to Congress in order to get constantly and enormously increasing appropriations, in preference to data he keeps in stock for local use.

Personally, I do not feel at all concerned by his denial of some statements I made in the SCIENTIFIC AMERICAN in describing the jetty work at the mouth of the Columbia River. My statements therein are his statements to Congress and my deductions therefrom are the inevitable conclusions from his statements and are merely conclusions. These deductions refer to the time it will take to create a 40-foot deep channel at the mouth of the Columbia River and they, of course, are fallible, being deductions. Facts, however, are infallible, and here are the facts on which my deductions were made, from page 1016 of his report:

"South jetty commenced 1885," 27 years ago. "Depth of water at bar, 19 to 21 feet. Depth of water in 1895, with 4½ miles of jetty done, 31 feet, and in 1899, 28 feet. By 1902 the depth had deteriorated to 21 feet," where it was 17 years previously. "The maximum of 1910 was 26½ feet and of 1911 was 27½ feet," an increase of 6½ feet in nine years. The deduction is that at his present rate of increase stated it will require 12½ years to secure 40 feet depth.

It may be that Major McIndoe will succeed, if he can spend $1,000,000 in that time, in completing the south jetty "in the early spring of 1913," but it will be what is termed the 1903 project, with 7½ miles of trestle work, if the teredo does not destroy it, and rock work up to low-tide level. Meantime, as stated above, the Major has an iron in the fire and wants $3,529,300 to boost the rock work up to mid-tide level.

New York. W. H. BALLOU.

[We are informed by the engineers on the work that it will require not to exceed six years to build the north jetty; and that this will place the time in which Portland can hope for a 40-foot depth at not to exceed seven years, at the end of which period, they assure us, both jetties should be completed.—EDITOR.]

The New York Electrical Show

THE New York Electrical Exposition, popularly known as the "Electrical Show," held this year in the new Grand Central Palace, October 9th to 19th, is an advance over former shows in the demonstrations of actual devices and in the educational exhibits setting forth the increased utilization of electricity. A distinctive feature of the present show is the presentation of the historical side of the electrical industry. It was just thirty years ago that the first Central Station for providing public incandescent electric lighting service in New York city was put in operation by the initiative of Mr. Edison, and very largely by his personal labor; and this year's show was fittingly opened by a luncheon given in his honor.

Heating and cooking devices have always been much in evidence at the Electrical Show, and this year the variety and ingenuity of these articles is greater than ever. Among them are an egg boiler, itself of attractive egg shape and holding five or six eggs at once, a samovar with removable tea-ball, a frying-pan that may be turned upside down for making griddle cakes, and a combination utensil by means of which one may prepare an entire breakfast—cooking a cereal, making toast, boiling or frying eggs, and broiling bacon, steak or chops—by changes and combinations of the movable part. Complete electric ranges show a remarkable advance over last year. A large space is given up to a ten room for visitors, with many little tables where electrically cooked viands are served.

The United States Government is well represented. Exhibits are made by the Census Bureau of tabulating and statistical machines, by the Bureau of Mines of mining apparatus and of an oxygen resuscitating equipment for miners, by the Reclamation Service of photographs of the arid lands of the West in their original desert state and after irrigation and of the vast engineering works for providing hydro-electrically generated power and irrigation, by the Navy Department, the Bureau of Navigation, the War Department, the Army Signal Corps, and by several Bureaus of the Department of Agriculture. The Electrical School of the Brooklyn Navy Yard has a striking exhibit with the bluejacket students in attendance and including a 20-kilowatt wireless telegraph installation with which the first wireless message will be sent to the Panama Canal. The Isthmian Commission provides a large operative model of the Gatun Dam, locks and spillways. Inventors' models and drawings relating to the early history of applied electricity—the Wallace dynamo and arc light, the Page motor, the reciprocating electric engine and certain other apparatus of Prof. Henry, and a model of the Morse telegraph register—are contributed by the Smithsonian Institution. New York State furnishes an operative model of the use of electricity on the Mohawk River at Yosts.

As in all "shows" of this special character, many exhibits, demonstrations and selling booths are found that have no direct connection with the main object of the show. One of the most interesting among the strictly electrical applications shown is an exhibit bearing on the problem of the food supply, viz., the stimulation of plant growth by electric radiations and electrified irrigation. A good-size model greenhouse is installed to demonstrate what may ultimately be done by electricity in the "forging" of garden truck to obtain early fresh vegetables and in increasing the yield. This demonstration represents an agricultural art which is still in the experimental stage. An actual utilization of electricity in connection with farming is set forth in large photographs, including those displayed by the Reclamation Service, already mentioned. A considerable space is given over to electric incubators and their products, including an actual barnyard scene with several family groups of mother hens, ducks, and Guinea hens and their artificially hatched broods. Electric lighting naturally figures largely in the show, both in the illumination and decorations of the building and in the special exhibits of the progress that has been made in electric lighting, including progress in tungsten lamps. An improved form of the so-called "straight-line" filament lamps, giving an evenly distributed illumination for desks, deserves mention. The demonstrations of commercial work include electric "spot" welding, small power applications, the lead storage battery and the Edison storage battery shown with the laboratory machines used to test the endurance of the nickel-iron cell to mechanical shock, etc., the new Edison alternating current rectifier, instructive literature on reading the electric meter, motor driven inclined elevators for the handling of goods in warehouses and department stores and the like. Among household applications of more or less novelty and use are "general utility" motors and "power tables," improved types of vacuum cleaners, washing machines and other labor-saving appliances. Several of the electricity supply companies of Greater New York and vicinity display instructive charts, automatic stereopticon views and photographs showing the growth and utilization of their product, in line with the remarkable activity of the "new business departments" of the central station companies nowadays; and the Brooklyn Edison Company has a 100-foot panorama of the Brooklyn water-front, realistically illuminated, to set forth the desirable features of that borough as a location for manufacturing enterprises.

The electric vehicle exhibition comprises many makes of pleasure carriages, commercial cars and industrial trucks. Special provision is made for the "demonstration" of all kinds of cars, including a ten-lap track surrounding the third floor of the hall and realistically arranged to simulate the real outdoors. Instruction in driving electric carriages will be given to women visitors, utilizing special appliances to make the learning easy.

Sinhalese Iron of Ancient Origin

By Sir Robert Hadfield, F.R.S.

THERE being little definite evidence regarding ancient iron, the author describes some specimens from the buried cities of Ceylon. His paper supplements one by Dr. G. Pearson, read to the Royal Society in 1795, on Indian steel of modern manufacture.

The specimens investigated, obtained from the Colombo Museum, through the kindness of the Governor General of Ceylon, Sir Henry McCallum, are (1) a steel chisel, fifth century A. D.; (2) an ancient nail, probably of same place and date; (3) a bill-hook. This date has been verified by Dr. A. Willey, F.R.S.

Examination of the chisel showed:

C	Si	S	P	Mn	Fe	Specific Gravity
traces	0.12	0.003	0.28	nil	99.3%	7.60

Difference being slag and oxide.

The Frémont shear test showed 16 tons per square inch elastic limit, 26 tons per square inch breaking load. The shock test showed 17 kilogrammes with 85 degrees bend before breaking. The Brinell ball test showed hardness numbers 144 and 144 on opposite sides. The scleroscopic hardness was 35. The transverse section shows the specimen to be somewhat carbonized, with carbonized areas on two sides. The presence of Martensite and Hardenite suggests the important information that the chisel was quenched.

The analyses probably represent the only modern complete determination of the composition of authentic specimens of ancient iron. The percentage of phosphorus, though high, does not greatly differ from modern bar iron. Sulphur is extxremely low, showing the employment of a very pure fuel. There is very little silicon, while manganese is entirely absent, which is somewhat remarkable since nearly all iron contains some manganese.

From microscopical examination and other tests it results that the specimens represent wrought iron rather than steel. They somewhat resemble puddled iron, and seem to have been made from rather impure ore. The percentage of carbon is low, as is the case of other impurities with the exception of phosphorus. Slag is present in considerable quantity in a lumpy, irregular form, indicating that the material was not submitted to the amount of forging undergone by modern wrought iron.

The author has also been able to obtain specimens from the actual Delhi Pillar. These have been analyzed, and it may be interesting to give the composition, which is as follows:

C	Si	S	P	Mn	Fe	Total
0.08	0.046	0.006	0.114	nil	99.72	99.966%

Specific Gravity 7.81%.

The iron percentage was determined and not taken by difference.

It will be noticed that this material is an excellent type of wrought iron, the sulphur percentage being particularly low, 0.006 per cent. This indicates that the fuel used in its manufacture and treatment must have been very pure; probably it was charcoal. The phosphorus percentage is 0.114 per cent. It will also be noticed that there is no manganese present, which is a somewhat special point, as wrought iron usually contains some manganese.

This is probably the first time that a complete analysis has been given of the material of which this pillar is composed.

Both the analyses now given represent material of almost similar composition. This is somewhat remarkable in view of the fact that these specimens were taken from places widely apart. The processes then prevailing of manufacturing this ancient iron were, however, evidently very similar in different parts of India.—Proceedings of the Royal Society, A, Vol. 86, 1912; also of the Iron and Steel Institute, May, 1912.

Landsman's Log Aboard the United States Destroyer "Patterson"—II.

By J. Bernard Walker

The present series of articles is a record of impressions gathered by the Editor, on a week's cruise aboard the destroyer "Patterson," during the summer maneuvers at the eastern entrance to Long Island Sound.

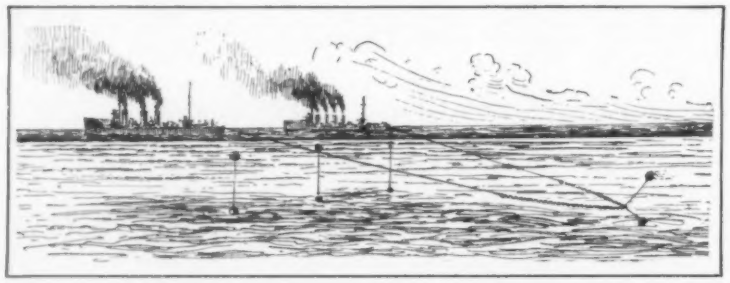
THERE is a sharp word of command from the bridge, followed by a crash, a reverberating rattle, and a prolonged shudder throughout the whole fore part of the ship, and we are at anchor for the night, or rather for the early part of it, within a mile of the clustered buildings which house the summer visitors to Block Island.

The day has been a characteristically busy one for the torpedo-boat destroyers. We were under way at five in the morning and have been ceaselessly engaged in a variety of maneuvers for the last twelve hours. It seems to me that we have put in a strenuous day's work; but a wireless has just been received from the Admiral, giving the programme for a series of night maneuvers, which will necessitate our getting under way at 10 P. M. for an all-night stretch of the most exciting, and certainly the most trying, of the duties which fall to this severely-worked branch of the naval service.

It is not of the night work, however, that I am now to write; I shall rather make some notes on the work of mine-sweeping, which has formed the exercises of the day now drawing to its close.

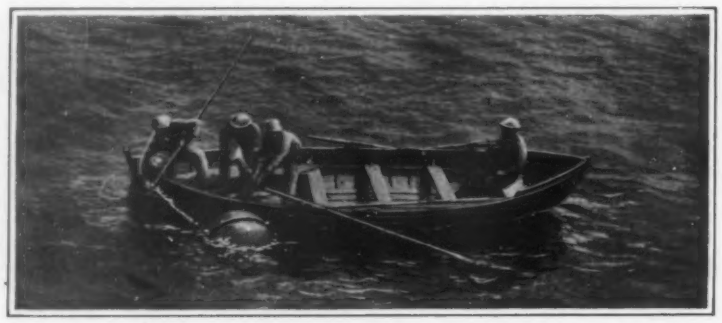
The torpedo boat, or rather the destroyer, as it is called (torpedo boats are no longer built for our navy), has undergone a development in size, speed and power, and the enlargement of its field of operations, which is as great and probably greater than that of any type of warship. The earliest torpedo boats were such diminutive craft and of such limited speed, that their activities were confined chiefly to the sheltered bays and harbors of the coastline; and even in that restricted sphere their value was very problematical. The first boats built for the British Navy in the late seventies and early eighties were little craft sixty feet long, seven to eight feet in beam, and of a displacement of from fifteen to twenty tons. Their best speed was from sixteen to seventeen knots. In 1885 the displacement had increased to forty tons, and in 1890 to eighty-five tons, the speed ranging from eighteen to twenty-two knots. Many of us still remember the "Stiletto," built by Herreshoff at Bristol, Rhode Island, in 1886. We were very proud of the famous craft in those days; yet she was only eighty-eight and one half feet in length, with a displacement of thirty tons, and her best speed on trial was a trifle over eighteen knots. In 1890 we were building boats of 120 tons displacement. In 1900 the displacement had risen to 165 tons and the speed to twenty-six knots; and by the year 1904, at the time of the Russo-Japanese war, the displacement of the torpedo boat (or destroyer as she had come to be called) was between four and five hundred tons and the speed had risen to thirty knots.

Now this war afforded a very severe test of the all-round value of the destroyer. It struck the first vital blow and gave to the Japanese fleet an ascendency which was never lost throughout the war. The Japanese put their destroyers to new uses. They employed them largely as dispatch boats, and for scouting and other service which took them out upon the high seas and called for extended cruising. The destroyer assumed a new importance. Its sphere of operations was greatly enlarged, and the advantages of greater displacement and better sea-keeping qualities were immediately recognized. Since that war development has been rapid. To-day, scouting duties with the fleet have been largely handed over to these craft, which now perform much of the work formerly allotted to the unprotected cruiser. Within the next three or four years, we shall see destroyers of from one thousand to fifteen hundred tons displacement, of thirty-five knots speed, and provided with a fuel supply which will give a greatly extended radius of action in company with the battleship fleets.



A length of chain, dragged by two destroyers through the mine field, clears a channel. The light draft of the destroyers enables them to pass clear of the mines.

Destroyers clearing mine field by "sweeping."



One of the "Patterson's" boats recovering a mine which has been broken adrift by the sweeping operations.

From the sailing cutters the mines are lowered into position by means of small cranes at bow and stern of the boats.

Lowering a platform with six mines from the deck of a battleship to a sailing cutter.

Our orders for the day were to proceed to a point off Watch Hill. There we would find a fleet of half-a-dozen battleships, surrounded by a mine field, which had been laid over night by the enemy, and through which, by the operation known as "sweeping," we were to open a channel for the escape of the fleet. Although the mines were supposed to have been planted by an enemy, as a matter of fact they had been laid down by the battleships themselves; and before proceeding to describe the sweeping operations as carried out by the destroyers, it would be well to explain the character of the mines and the method of planting a mine field.

The mine consists of a hollow metal sphere, loaded with one to two hundred pounds of high explosive; a cylinder loaded with ballast; and a connecting length of wire cable. The loaded cylinder is lowered to the bottom and serves as an anchor to hold the mine in place. The mine with its explosive is connected to the ground anchor by the cable, which is so adjustable that the mine will float at a predetermined depth—say from twelve to fifteen feet below the surface of the water, the cable paying out or taking up, as the tide rises and falls. The spherical mine with its charge of high explosive being buoyant, tautens the connecting cable and floats at the desired depth, which is so chosen that the mine will strike the submerged hull of a warship well below the surface of the water. The mines are laid in successive rows, which are so placed with regard to each other, that a ship which might pass through the first row will be certain to strike a mine of the second or third row.

Each battleship carries a complete outfit for mining operations, and the seamen are instructed how to load the mines, adjust the automatic firing mechanism, connect up the cables, and put everything in ship-shape condition for mine-planting. The large illustration shows the crew at work on the quarterdeck of a battleship, assembling the mines ready for planting.

The mine-laying is done by the ship's boats. Stout timber platforms are constructed on the deck of the battleship, and along opposite sides of this are placed three mines with their respective anchors suspended over the sides of the platform. The ship's boats are brought alongside and the platforms are lifted from the deck of the warship, and lowered down upon the gunwales of the boats, as shown in the accompanying illustration. When the boat has been towed to a designated position in the mine field, the anchors are lowered in succession by means of small cranes rigged at bow and stern of the boats, and the spherical mines are dropped over after them. Row after row is planted at suitable intervals, until the whole channel has been covered.

In yesterday's exercises the fleet made its way out of a harbor menaced by a group of submarines. To-day it was supposed to be forcing its way out of the same harbor through a mine field. Yesterday it was the duty of the destroyers to detect, and if possible sink, the submarines. To-day it was the duty of the destroyers to open up a wide channel through the mine field, either by removing the mines or by exploding them.

The first thing to be done was to lay out a course on which the channel was to be cleared. Accordingly, the "Patter-

son," acting under wireless instructions from the Admiral of the beleaguered fleet, steamed on the outside of the mine field to a designated position, and then sent in six destroyers, which passed over the mine field (which they were able to do in safety, since the mines were fifteen feet below the water and the destroyers draw only eight or nine feet) to the fleet.

Two of the destroyers then took station a few hundred feet apart, and a length of chain cable was payed out from the stern of one to the stern of the other boat. The ends of the chain were made fast to two lengths of towing cable, and it was allowed to drop to the bottom. The two destroyers then steamed across the mine field in the direction of the "Patterson" at a speed of three or four knots, dragging the chain cable over the bottom. As the cable encountered the anchors of the mines it would slip up over them and catch the wire rope extending from the anchors to the buoyant mines above. Under the pull of the destroyers, these ropes would slide into the bight of the chain; and, if the mines were not theoretically set off by the shock, the anchors, the anchorage ropes and the mines themselves would be dragged along by the destroyers clear of the mine field. A little to one side of the course thus swept over by the first two boats, another chain was dragged, clearing another hundred feet or so, and then the third pair of destroyers dragged their chain across the mine field. As the destroyers reached the "Patterson" they bore off to port or starboard, dragging the captured mines clear of the channels. Finally, another pair of boats worked over a wide area through the center of the channel thus cleared, so as to make sure of removing any mines which might have escaped the first sweeping.

Theoretically, the channel was successfully cleared, and the fleet steamed out through the mine field without the loss or injury of a single ship. Let it not be supposed, however, that mine-laying or mine-sweeping will be the comparatively simple operation which we witnessed that morning. As a matter of fact, it is one of the most dangerous possible. In the first place, the mine fields which cover the approaches to a harbor are almost invariably protected by a battery of heavy rapid-firing guns on shore. Counter-mining or sweeping would have to be carried on under a heavy fire. Similarly, if the ship's boats attempted to plant a mine field in the approaches to a harbor, the work would in all probability have to be done under the fire of the enemy's scouts or destroyers.

But, dangerous as this work will inevitably be, the history of our navy has shown that the greater the perils of any given service, the greater is the enthusiasm of the officers and men to undertake it. Popularity of any naval service is gaged, not by its dangers, but by the magnitude of the results which can be achieved. The experience of the Russo-Japanese war showed how deadly are the torpedo and the submarine mine; and it is certain that the navy which is highly proficient in mining operations, whether for attack or defense, will have a strong physical and moral advantage over an enemy that is deficient in this kind of warfare.

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Mining operations in the Atlantic Fleet.

The crew of a battleship are here engaged in assembling the mines ready for planting.

Lightning and Our Forests

BULLETIN 111 of the United States Forest Service is a contribution to an unexplored field of research which promises to stimulate new and fascinating inquiries. The author's aim in the work, as he has clearly outlined it in the introductory paragraph, has been to arrive at some definite conclusions regarding the relative frequency with which trees are struck by lightning, the conditions which tend to produce the greatest danger, and the relative susceptibility of different kinds of trees. With the advent of a scientific fire protection on the National forests naturally came a fuller inquiry into the causes of forest fires. The result has been the compilation of data from all parts of the United States relative to the frequency of forest fires from lightning. The data have been gathered chiefly on the National forests by nearly 3,000 forest officers. In addition to these field data extensive laboratory experiments were conducted with a view to determine the electric conductivity of our native woods.

It was no slight task to attempt to bring within the compass of less than 30 printed pages a review of the history of past investigations, a discussion of the theories and beliefs held by the layman, as well as an explanation of the results of the author's own data and experiments. It is, however, a most admirable endeavor and is executed as well as the nature of the subject probably permits. All who have made a study of lightning and are acquainted with the paucity of reliable printed matter dealing with the subject, are familiar with the difficulties that surround the decipherment of what records there are. The author's own figures are all based on reliable data and his conclusions will probably stand the test of much more extensive researches, which others may conduct later.

This bulletin, which can be had for the asking, should be in the hands of every forest officer in the country. The publication should not only be in his possession, but it should be read very carefully. There are very erroneous impressions in the minds of the layman to the effect that certain trees are more liable to be struck by lightning than others, and the general public should be familiar with the findings as set forth in this bulletin. The author's conclusions are as follows:

1. Trees are the objects most often struck by lightning because: (*a*) They are the most numerous of all objects; (*b*) as a part of the ground they extend upward and shorten the distance to a cloud; (*c*) their spreading branches in the air and spreading roots in the ground present the ideal form for conducting an electrical discharge to the earth.

2. Any kind of tree is likely to be struck by lightning.

3. The greatest number struck in any locality will be of the dominant species.

4. The likelihood of a tree being struck by lightning is increased: (*a*) If it is taller than surrounding trees; (*b*) if it is isolated; (*c*) if it is upon high ground; (*d*) if it is well (deeply) rooted; (*e*) if it is the best conductor at the moment of the flash; that is, if temporary conditions, such as being wet by rain, transform it for the time from a poor conductor to a good one.

5. Lightning may bring about a forest fire by igniting the tree itself or the humus at its base. Most forest fires caused by lightning probably start in the humus.

Aviation at the French Maneuvers

Military Use of the Aeroplane by the Leading Air Power

By Stanley Yale Beach

ALTHOUGH the chief use of the aeroplane, as foreseen by the Wright brothers, was that for military purposes, France was the first country to employ this modern machine in the maneuvers which take place every fall. In the maneuvers of Picardie in 1910, three or four aeroplanes were supplied by the manufacturers for the purpose of showing what could be done. Last year military aviation had become half way organized and there were a number of aeroplanes arranged in groups of three or four, but the commander-in-chief did not make much use of these and did not recognize all their possibilities. This year aviation has advanced by such leaps and bounds that there were nearly four-score aeroplanes on the ground, and these machines were all arranged in separate "escadrilles," or groups, consisting of from five to eight machines each. The generals in command were able to call upon the pilots of these aeroplanes to go out on scouting and message-carrying trips at a moment's notice, and so well did they accomplish this that there were no accidents throughout the entire maneuvers, and the headquarters of each army was always posted as to the latest movements of the enemy. The arrangement of the armies in the maneuvers this year was as follows:

The Blue Army, located in Anjou and commanded by General Gallieni, included the 10th and 11th Corps and the 1st Division of Cavalry, while the Red Army, scattered along the upper Creuse, and commanded by General Marion, included the 9th Corps, the 3rd Division of Infantry, and the Colonial and 7th Division of Cavalry. With the division of reserves the entire number of troops was about 120,000, the whole being under the direction of the commander-in-chief, General Joffre.

The two contending armies were each provided with four escadrilles of aeroplanes, an escadrille containing on an average six machines. The Blue Army force consisted of two escadrilles of Henri Farman two-seated biplanes, one of Blériot monoplanes, and one made up half of Blériot and half of Borel monoplanes. The Red Army, on the other hand, had one escadrille of Deperdussin two-seated monoplanes, one of Maurice Farman biplanes, and one of Hanriot monoplanes, while the forth was a mixed escadrille of three-seaters, including two Deperdussin monoplanes, two Breguet biplanes, and two Nieuport monoplanes. Each aeroplane was obliged to carry the necessary spare parts and each army had, besides, a complete equipment of motor workshops, etc., consisting of one motor truck for every two aeroplanes. One of our illustrations shows a portable repair shop, which consists of a large van containing a lathe, grinder, vise, and all the various tools and necessary equipment for repairing the engines and every part of the machines. When the repair automobile is moving along the road, the sides fold up and make a closed van, but when it is put into use on the field, the sides are dropped down, as shown in the illustration, and thus making ample work benches for the mechanics. For the transportation of aeroplanes, when they do not fly from point to point, large two-wheeled vans are provided in which the aeroplanes are placed in a semi-dismounted condition and drawn from point to point by attaching the two-wheeled van to the rear of a motor truck.

The maneuvers of the West, as they were called this year, occupied two weeks from the 8th to the 21st of September. Operations began on September 11th, when the two airships used in connection with the aeroplanes, the "Dupuy de Lome" and the "Adjudant Reau," remained aloft and reconnoitered for a period of eight and six hours, respectively. The twenty-four aviators allotted to each army were actively engaged in flying and scouting throughout the day. Hundreds of flights were made and several thousand miles were covered by the forty-eight machines which were in use. The rules were that if an aeroplane landed in the enemy's country, it would have to be brought back to headquarters and remain neutralized for twenty-four hours. Among the lengthy flights made on the 13th were four of about 125 miles each, made by three lieutenants and one sergeant. During the first part of the maneuvers, which lasted three days, out of the forty-eight aeroplanes engaged, eleven were temporarily disabled, and four of these were captured by the enemy. Nevertheless, General Gallieni congratulated his aviators on the abundance and correctness of the information they gathered. He stated that he had made his decisions largely on this information, and that he had never found himself in a bad position from having done so.

As all the military pilots were skilled aviators and had had experience in flying, it is not to be wondered at that the reports they gave were wonderful in their accuracy and detail. The fact that each aviator generally has a companion to take note of the country below him and report on the movements of the troops, made it all the more possible to give accurate information. In one instance a well-known aviator landed beside Grand Duke Nicholas of Russia and gave him personally a report of his scouting flight. The Grand Duke was so enthused at receiving this information that he had the officer sign the report, and he sent it to Russia to show what is being accomplished by the French military aviators.

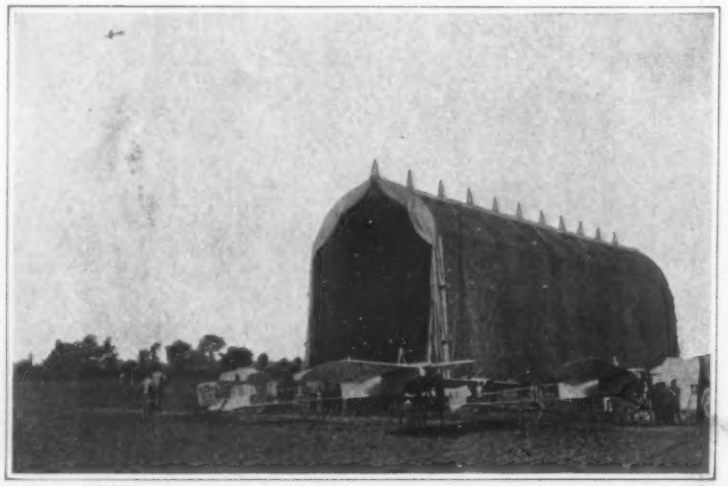
In addition to this gleaning of accurate information promptly by the scouts, such information was at the disposal of the Generals instantly by means of wireless telegraphy. The Farman biplane of escadrille No. 2 was fitted with a new wireless transmission set, the invention of M. Rouzet. This set consists of a small dynamo driven from the aeroplane motor by means of sprockets and a chain and absorbing not more than half a horsepower, and an antenna consisting of a wire about 150 feet in length—sufficient for transmitting messages a distance of 62 miles. The weight of the entire apparatus is but 66 pounds, and the space it occupies is 10 by 10 by 26 inches high. During a two-hour reconnoiter on September 16th, in which the inventor was at the key of the instrument in the aeroplane, messages were sent continuously during the flight and headquarters was kept in touch with all that was going on about the field. When the aeroplane was at a height of from 1,650 to 5,250 feet, the communication was perfect. Fog and clouds were often interposed between the aeroplane and the receiving station, but neither affected communication. This new system has the advantage that there is no interference with other stations and only the special portable receiving stations can catch the messages from the aeroplane. The apparatus is so simple that an ordinary sapper can, after about two months' training, be used for the purpose of sending messages.

After many more excellent flights had been made during the course of the same maneuvers, the latter were terminated by a grand review of the aeroplanes by M. Millerand, Minister of War. This took place on September 27th. M. Miller-

(Continued on page 336.)

Courtesy of *L'Illustration*

An escadrille of Farman biplanes.



Courtesy of *L'Illustration*

A Blériot escadrille in front of a dirigible hangar.

Repair automobile with side lowered to form a work bench.

Sharpshooters trying to pick off a Blériot monoplane pilot.

Anchor Mast for Dirigible Balloons

THE picture herewith represents a device for mooring dirigibles safely in the open air, which for theoretical reasons has been repeatedly recommended in the columns of this paper, and which has been put to the practical test by the British Air Battalion with complete success during the summer of 1911. It consists of a mast of steel lattice work, made in three pieces. It is erected on a block of wood and held upright by four steel cables. Around its top swivels a large cone, made of wood, covered with canvas and upholstered on the inside. This cone is intended to fit like a cap over the front end of the envelope of the dirigible.

The device works as follows: The airship is landed near the mast. A "tassel" of ropes hanging out of the cone is pulled out, and the rope ends are strapped individually in a circle around the front end of the envelope. The dirigible is then taken nearer the mast, the cone is brought in line with it, and by pulling from the ground on a strong steel cable, to which all the single ropes of the "tassel" are made fast, and which runs over a pulley drop in the apex of the cone, the front end of the envelope is drawn firmly into the padded cone.

In an exhaustive trial during a very rainy and stormy night, it was proved that the airship thus moored and with the envelope kept stiff by a blower, pumping air from the ground through sixty feet of four-inch hose into the ballonet, swings with the wind as freely as a weathervane, while the cone prevents any collision with the mast, if the wind becomes very irregular.

The Lookout Mountain Road

A REMARKABLE piece of road-building has been done in the vicinity of Los Angeles, California, on an automobile highway from Laurel Canyon to the summit of Lookout Mountain. It is just wide enough for one vehicle, and has one route for the ascent and another for descending cars. It rivals the famous roads of Norway and the Alps in its multitudinous Y's, hairpins and sharp turns. The side of the steep mountain is actually terraced by this road and six levels are shown in the photograph, one directly above the other. The popularity of this run is shown by the string of cars on a holiday. The grades are very easy and the road is perfectly safe. The roadbed is of decomposed granite, making a splendid surface. The road was built recently to lead to a summer hotel on the summit.

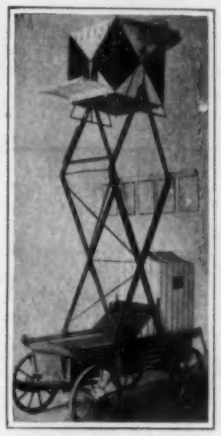
A Woodpecker's Storehouse

THE accompanying photograph shows in a realistic manner both the industrious and damaging habits of the energetic California woodpecker (*Melanerpes formicivorus bairdi*). It is a section of a telegraph pole that stood recently along one of the railroads near the Pacific Coast, which, as will be seen, has been fairly riddled and honeycombed on its four sides by thousands of holes pecked and bored out by the bird. Of course, these numerous cavities weakened and destroyed the usefulness of the pole, which had to be cut down and replaced by a new one. The damaged telegraph pole is the result of the wisdom and foresight of this smart little bird who is able to see far beyond the end of his bill. It was occasioned by the problem of food and a practical knowledge of the necessity of laying something by for a rainy day. When autumn leaves begin to fall and hints of frost are in the atmosphere the woodpecker puts in his spare moments hiding fat, juicy acorns in nice little cavities pecked out by himself in pine trees. If these are scarce in the particular region of his habitat a high telegraph pole is considered ideal for a safe storage plant.

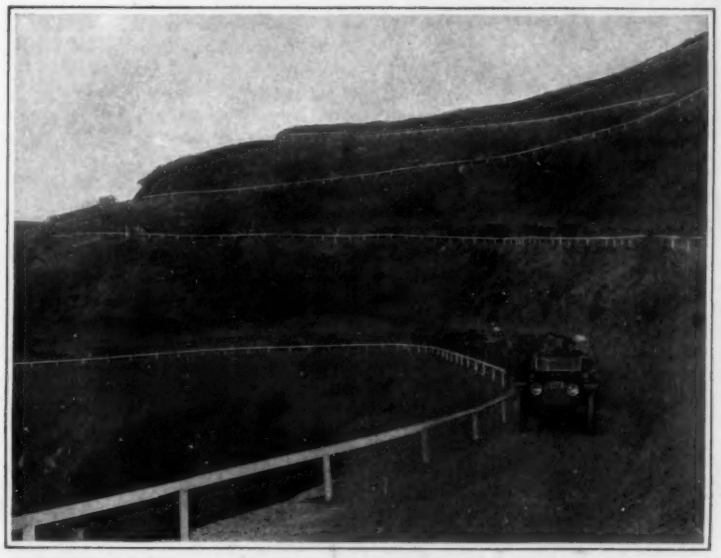
Though practically hidden from outside interference, these food store-houses are not beyond the reach of certain pilfering enemies of the bird and animal world, such as the jays, magpies and squirrels. To be on the guard against these robbers, the bird bores a deep cavity sufficient to take in his whole body, and there he stations himself to guard against any approaching marauders and trespassers. In consequence, there are numerous battles, and the ordinarily well-disposed and peaceful woodpecker, among its kind, becomes a vigorous fighter and all intruders are attacked and driven away in a hurry. During the spring and summer the food supply of the woodpecker consists of fruits, berries and to a great extent of various insects. From its destruction of the young larvæ and many insect pests, the bird is looked upon as of considerable economic value in the community.

Dirigible anchorage.

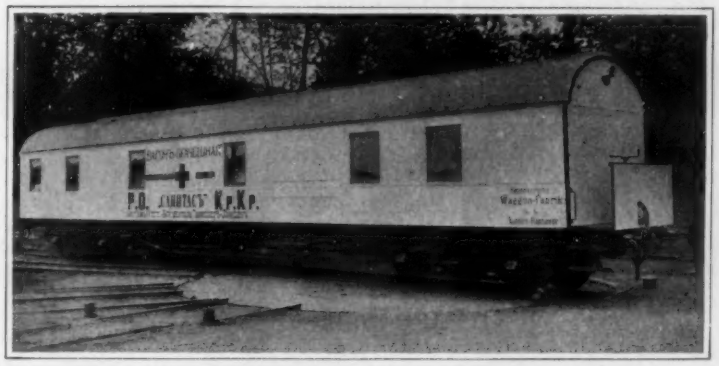
Woodpecker's storehouse.



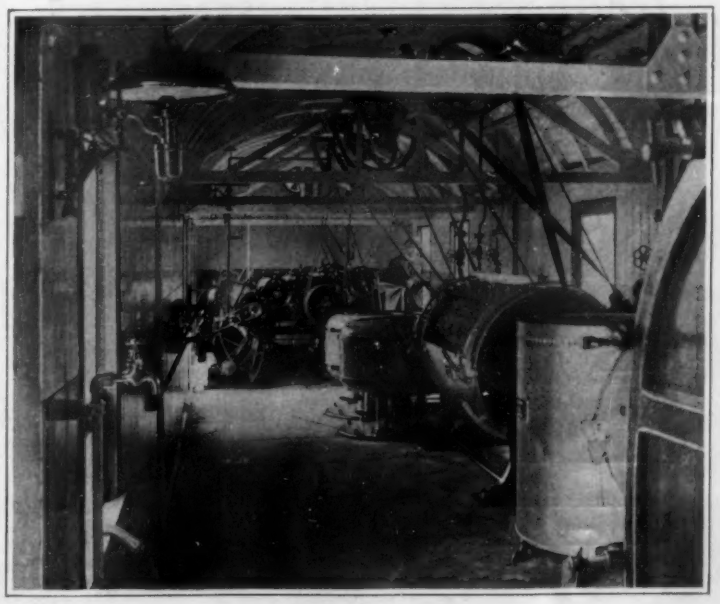
Pigeon scout photographic station.



The one-way road up Lookout Mountain, California.



Laundry car for the Russian army.



Laundry machinery installed in the car.

Pigeon Scout Stations

EXPERIMENTS have been made in Germany in the use of pigeons for scouting purposes. The pigeons are provided with miniature cameras furnished with shutters that are released automatically. The birds are set free from such points that they are liable to fly over the enemy's fortifications. When they return home the photographs they have taken are developed, and the chances are that some important disclosure will appear on the film. A field station for pigeon scouts is shown in the accompanying photograph. It consists of a vehicle on which is a small dark room, and which also carries a pigeon cote. The latter is supported on a pair of lazy-tongs, so that it may be elevated to the position shown in the photograph by operating a pair of crank handles at the rear of the vehicle. When the pigeon flies into the cote, the latter is lowered and the camera is removed from the pigeon, after which the film is developed in a few minutes.

Laundry Car for the Imperial Russian Troops

A LAUNDRY car has recently been introduced on the Russian Government Railways, for the use of the Imperial troops. It was built at the Hanover Wagon Works, Hanover-Linden, Germany. The car has a width of 9 feet 10½ inches, and a height outside at center from rail level of 13 feet 9 inches, and is built according to the Russian standard 5-foot gage. The equipment includes steam boiler, condensing tank, feed pump, injector, steam engine, cold and hot water tanks, soda cleansing medium, washing machine, draining box, centrifugal dryers, mangle, fans, ventilator, and disinfector, together with ironing board, with heaters at the finishing end, the central portion being used for drying and storing the linen. Thus a complete laundry on wheels is provided which should do much toward improving sanitary conditions in the army.

A Wind Wagon for the Sahara

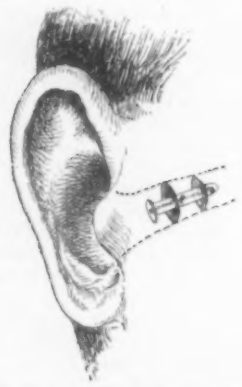
LIEUT. LAFARGUE, commanding the Sahara aviation center at Biskra, has just made a report to the Algerian headquarters relating to some experiments with a new method of traction which may prove very useful in crossing the desert. The apparatus consists of a sled which is driven by a propeller and a 50 horse-power aeroplane motor. The details of the apparatus are not given, but it is said that it will carry three persons and can easily circulate upon the sand dunes at a speed of 20 miles an hour or even more. It is the invention of Capt. Cros, and was designed in the first place to convey aeroplanes in the desert across the sand dune region of Grand Erg, which it was hitherto impossible to cross by any kind of vehicle, and it may prove not only a valuable aid in aeroplane work, but also come into use in general for transport in the desert regions. The first trials were made in July and will be followed by others in October. The officers propose to fit planes upon the sled so that it will act partly on the principle of the aeroplane.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

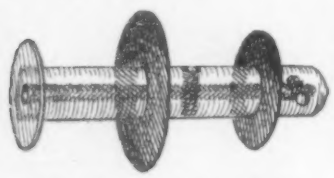
Ear Protector for Gunners

IN the SCIENTIFIC AMERICAN of March 9th, 1912, we described an ear protector used by men on our battleships and by the United States Coast Artillery companies to prevent injury to the inner ear from excessive or injurious vibration due to concussion caused by the discharge of firearms. The inventor of that device has recently improved it considerably, as shown in the accompanying illustration. It will be recalled that the protector shown in our previous issue was in the form of an anchor with a bulb at the end



Position of the protector in the ear.

which fitted into the ear passage. The disadvantage of the device lay in the fact that it was not very comfortable in the ear, as it afforded poor ventilation and was too apt to be misplaced accidentally. For this reason the present device was invented. It consists of a tube of celluloid bearing two thin washers or diaphragms of rubber or leather. The bore through the celluloid tube has ports between the washers and terminates in a passage running at right angles to the bore at the inner end of the device. In this way there



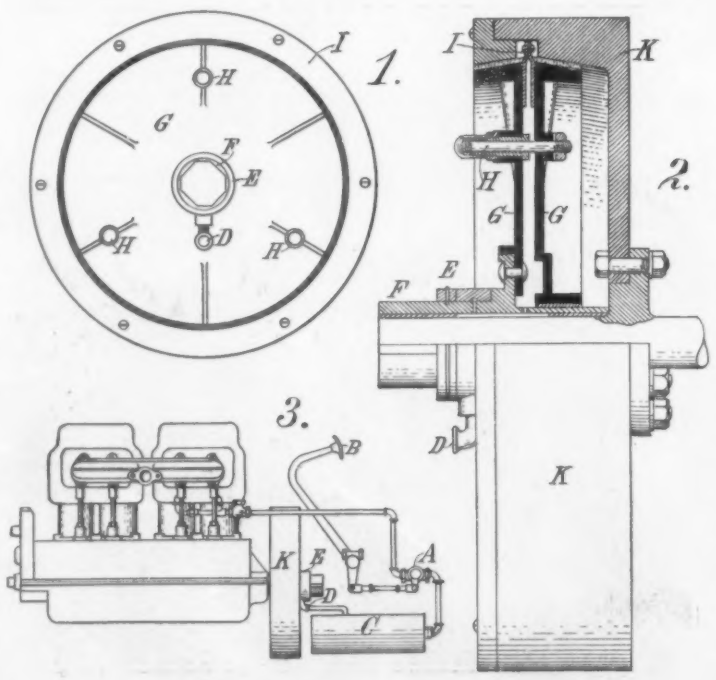
Enlarged view of the protector.

is thorough ventilation of the ear, so that the device may be worn with comfort. It must be understood that the device is not a plug, but in a true sense of the word a protector. The small bore in the celluloid piece will not carry the heavy vibration due to the concussion movement of the air, but will admit ordinary sound waves, so that it is possible to converse and hear conversation very plainly with the protector in the ear. The passage through the protector is so disposed as to prevent the concentration of the sound waves by the pinna of the ear. It will not only prevent gun deafness, and "ringing ears," but will shut out wind, dust or water from the ear canal.

Pneumatic Clutch for Automobiles

AN inventor, living at Los Angeles, Cal., recently devised a pneumatic clutch for aeroplane engines. The clutch was experimentally fitted to an automobile, and on a test run to Santiago it gave such excellent results that it was decided to manufacture this form of clutch for automobiles. On this test run an air pressure of less than one pound was employed in the clutch, and its ease of contact and quick release were very satisfactory.

The operation of the device was as follows: By means of small ports tapped into the cylinder at the bottom of the stroke a pressure of about two pounds could easily be obtained under lowest throttle. This exhaust gas was led through a small pipe to a check valve and then to a three-way valve *A*, Fig. 3, operated in this instance by a foot pedal *B*, and connected in the conventional manner to the emergency brake. The three-way valve transmitted the pressure to the clutch on retracting the pedal and released the clutch when the pedal was pushed down. The pipe line leading from the valve *A* entered a small tank *C*, which acted as a reservoir to take up the pulsations from the cylinder, thence the pipe line continued to the clutch, entering it at the point *D*. Fig. 2 shows the clutch partly broken away to reveal the interior details. The exhaust gases under pressure were led to a ring *E*, which was stationary upon the clutch sleeve *F*, and passing through a channel in this ring the gas was admitted through ports in the sleeve to a space between the two movable cone-shaped members *G*. These cone-shaped members were mounted back to back and coupled together with pins *H* which, owing to their sliding engagement with one of the members, allowed the members to move apart. The members *G* were also connected at their peripheries like a bellows by means of two leather bands *I*, as shown to best advantage in Fig. 1. The cone faces of the members *G* were coated with granulated compressed cork, so as to provide better gripping surfaces. The air pressure introduced between the members *G* caused them to spread apart, and engage the outer member *K* of the clutch. The pressure of a fraction of an ounce would bring the friction surfaces into contact, after which a steadily increasing pressure would develop until the car was started. The transmission of from one to one hundred horse-power as the pressure increased was readily accomplished. The cam lever was connected to the gear-change shaft, and owing to the easy engagement and quick release of the gears it could easily be shifted when not under strain without attention to the foot pedal.



Pneumatic clutch for automobiles.

The Diesel Patent

By Hayner H. Gordon, United States Patent Office

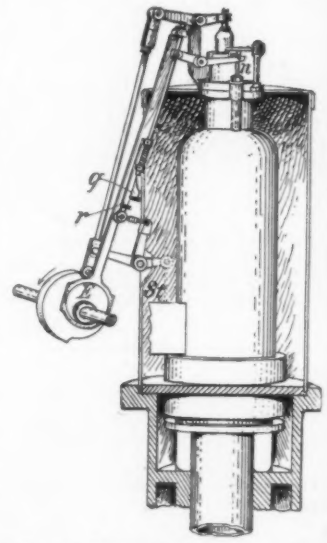
THE twentieth century may well be called the oil age. If one but stands for a minute upon a street corner of any of our large cities, and notices the number of automobiles passing, and considers the increasing number of vehicles of the air, or goes to the river bank and watches the countless motor boats rushing to and fro, he realizes how dependent humanity is upon petroleum. And when we stop to consider for a minute how very young the art of self-propulsion is and what rapid strides it has made in the last few years, we cannot help but feel that the coming years will bring before the world a period which should be designated in the life of our planet as the oil age.

So after all, we should give due credit to those pioneers in the oil fields of Ohio and Pennsylvania who have done so much to promote the science of self-propulsion. For without petroleum we would not have the automobile, the aeroplane, or the motor boat; at least it is safe to say that we would not have reached a point so far in their development. For, as with other inventions, the aeroplane, the automobile, and the motor boat have been both bettered and cheapened by the advent of the internal-combustion motor.

We have now reached the time in the development of the internal-combustion engine at which we appear to be about to take a stride forward. Within the last few years a new type of motor has been pushing its way to the front. This is the Diesel engine, an engine whose wonderful popularity is due chiefly to three points. The first of these is the fact that it runs on crude oil or petroleum at an efficiency of 0.38 pound of fuel per brake horse-power an hour. The second is that it may be very reliably designed in large units, engines of this power having been constructed as high as 12,000 horse-power. The third point lies in its extreme simplicity.

Public interest appears to be all the more awakening in this wonderful engine, owing to the fact that the basic patent expired upon July 16th, 1912. The purpose of this article is an attempt to show something of what this patent contains, and to make clear to the public just what will become of their property upon its expiration.

The Diesel engine is protected by three patents granted to Dr. Rudolph Diesel as follows: 1. No. 542,846. Method of an apparatus for converting heat into work, patented July 16th, 1895. 2. No. 608,845. The internal-combustion engine, patented August 9th, 1898, reissued April 2d, 1901. 3. No. 673,160. The method of igniting and regulating combustion for



Speed regulating mechanism of the original Diesel engine.

internal-combustion engines, patented April 30th, 1901.

The Diesel process in brief is as follows: Air is drawn into a cylinder by the downward stroke of a piston; the piston then moves upward, compressing the air into a very small clearance space at the top of the cylinder. The high compression used increases the temperature of the air to a point above the igniting point of the fuel used. Simultaneously with the downward stroke of the piston, the fuel is admitted in either solid or liquid form into the cylinder for a portion of the stroke. The fuel at once ignites, and combustion taking place, energy is developed in the resulting gas, which continues to expand during the remainder of the working stroke. The exhaust stroke then takes place and the cycle is repeated. This process in brief is the process set forth by the patent issued to Diesel July 16th, 1895. It is interesting to note that either solid or liquid fuel may be used. For solid fuel an arrangement is made of a rotating valve containing a pocket, as shown and described in the application; for liquid fuel the use of an ordinary spray nozzle is advocated. It is also stated in the application that liquid fuels may be profusely converted into vapor and introduced in this form. Perhaps the two most important points set forth in this application is that the introduction of fuel takes place gradually in order that the pressure will not rise too abruptly; and also that preparatory compression of the air in a separate cylinder, before admission into the main cylinder, may be used together with an injection of water into the compressor if necessary, in order to keep the temperature of the preparatory moderately low. It is further suggested in the application that the expansion or working stroke may be carried to a point at which the temperature of the exhaust gases are brought by expansion to a point below that of the atmosphere, thereby producing a gaseous medium which could be used for refrigerative purposes.

The speed-regulating mechanism of Die-

sel's original engine is shown in the accompanying engraving. The eccentric *E* moves the rod carrying the steel side piece *q*, fastened thereto, up and down and in an oviform curve. The fuel admission valve *n* is opened by the rod which carries a small steel block *r*. This steel block *r* engages for a certain portion of the circular travel with a steel piece *q*. The length of the engaged travel is determined by the position of *r*, which is regulated by the linkage mechanism *St*, which is connected with the governor. This means, therefore, determines the cut-off point for the fuel. The use of compressed air for starting the engine is suggested where supplementary air compression is used; the air for this purpose being stored in a reservoir. The use of a separate cylinder for the expansion of the exhaust products is suggested. The claims of the patent are as follows:

"1. The herein described process for converting the heat energy of fuel into work, consisting in first compressing air, or a mixture of air and neutral gas or vapor, to a degree producing a temperature above the igniting point of the fuel to be consumed, then gradually introducing the fuel for combustion into the compressed air while expanding against a resistance sufficiently to prevent an essential increase of temperature and pressure, then discontinuing the supply of fuel and further expanding without transfer of heat.

"2. In an internal-combustion engine, the combination with the cylinder and piston, of a valved suction inlet for air or a mixture of air and neutral gas, a valved fuel feed constructed to gradually discharge the fuel into the cylinder, and means in operative connection with the feed valve for opening the same at the commencement of the working stroke of the piston and for closing the same at a predetermined part of the stroke, substantially as described.

"3. In an internal-combustion engine of the character specified, the combination of a combustion cylinder provided with means for gradually introducing fuel therein up to the point of cut-off, a compressor for air, a reservoir connected with the latter and with the cylinder, and an expansion chamber for the exhaust gases, substantially as described."

The patent of August 9th, 1898, will apparently still give protection to the inventor in a large majority of cases. This will be seen from claims 7 and 9 of this patent, which are as follows:

"7. In an internal-combustion engine, the combination with a cylinder and a piston constructed to compress air to a degree producing a temperature above the igniting-point of the fuel, of a fuel-feed, and a valve mechanism adapted to open the fuel-feed somewhat in advance of the end of the compression stroke of the piston and to keep it open during part of the working stroke, substantially as and for the purpose specified.

"9. In an internal-combustion engine, the combination of a cylinder and piston constructed and arranged to compress air to a degree producing a temperature above the igniting-point of the fuel, a distributing-valve for fuel, and a cut-off for varying the time and duration of the supply of fuel by said valve, substantially as described."

It will be noted that the two main points set forth in these claims over the original patent are: first, an admission of fuel before the completion of the compression stroke, and secondly, a variation in the time of fuel admission as well as the duration of fuel admission. The other points of novelty occurring in this second patent are: the use of a burner or burners similar to the ordinary Bunsen burner for the introduction of fuel into the combustion chamber, and an air supply pipe from the air supply pipe of the cylinder in communication with the fuel supply.

The reissue No. 11,900 of April 2d, 1901, sets forth in addition to the points given above, the idea of a valve mechanism consisting of a double set of cams which may be shifted so as to allow the engine to run on either the two-stroke cycle or the four-stroke cycle. Claim 10 of the reissue, which reads as follows, shows how broadly this device is covered:

"10. In an internal-combustion engine, the combination with the cylinder provided with fuel and air valve mechanism for operating same on a four-stroke cycle, and with means for supplying compressed air thereto, of valve mechanism controlling such compressed-air supply and means for operating said valve mechanism to enable the cylinder to work with compressed air on a two-stroke cycle."

The last patent of the series, that of April 30th, 1901, while not as important as the above mentioned patent, is interesting, in that it provides a novel arrangement of ignition. Claim 1 of this patent appears to be practically self-explanatory. The claim reads as follows:

"1. The method of regulating combustion in internal-combustion engines which consists in producing a mixture of air or oxygen and a combustible, compressing the mixture to a temperature lower than the igniting-point of the combustible, and introducing under excess of pressure into the mixture a secondary combustible, the igniting-point of which is equal to or below the temperature due to the compression, substantially as described."

In view of the foregoing it will be noted that anyone constructing an engine of this type could use the Diesel principle only provided he employed a fuel admission which began on an upper dead center. The cut-off could of course be made variable. The most important point in this limitation arises from the fact that the feature of not being able to admit fuel before the piston has reached the top of the compression stroke, limits public use exclusively to a slow running engine. It is absolutely necessary to obtain an advanced fuel admission in a high speed Diesel engine, just as it is necessary to use an advanced or early spark in the Otto cycle.

It will be noted in summation, that the Diesel engine will after all only become public property to a somewhat limited degree. As in other cases, however, the very limitation set upon that which the public receives may perhaps arouse more stimulus than it otherwise would in the mind of the inventor and thereby, after all, work for the greater benefit and furtherance of the internal-combustion engine in the development of the oil age.

Early Attempts to Protect Trade-marks

By William L. Symons of the United States Patent Office

THE first Federal law providing for the registration of trade-marks in the United States Patent Office was passed, as is well known, in 1870. Long prior to that date, however, attempts were made to protect trade-marks by depositing them in the Patent Office.

The earliest effort was made under the design patent act of 1842. This law provided in part that anyone who had invented

. . . "any new and useful pattern, or print or picture, to be either worked into or worked on, or printed or painted or cast, or otherwise fixed on any article of manufacture"

might obtain a patent therefor. Under this provision of the act it was thought that a trade-mark could be patented, and thus an exclusive right to it be secured. The Patent Office agreed with this view, for it soon began to issue patents for "designs for trade-marks." These patented trade-marks were applied, as stated in the application, to such goods as commonly bear trade-marks to-day, and consisted usually of the entire label placed on the goods. Upton, in his "Law of Trade-marks," published in 1860, which was the first text on this subject written in the United States, condemned this practice of granting such patents, and very clearly showed that it was not the purpose of the design act to protect the mere name or ornamental device by which certain articles of manufacture were known. His conclusion was:

"The policy of continuing such an unwarrantable construction of the law is, to say the least, very questionable."

His view of the law did not carry conviction, and the practice was continued until 1870, when some two hundred of these patents for trade-marks had been issued. Commissioner Fisher in that year stopped the practice, pointing out that the trade-mark law which had just been passed afforded ample protection to trade-marks, and that it had only been by a forced construction of the provisions of the design law that trade-marks had been included within it.

In 1869, however, jurisdiction was regularly conferred upon the Patent Office to accept the deposit of trade-marks by the citizens of Russia. The convention between that country and the United States proclaimed at that time prohibited the counterfeiting of the trade-marks of the citizens of the respective countries, provided for an action for damages in the courts of these countries, resulting from wrongful use, and required the marks of Russian subjects to be deposited in the United States Patent Office and of citizens of the United States to be deposited in the Department of Manufacture and Inland Commerce at St. Petersburg. Similar treaties were concluded with France and Belgium in 1869 by which citizens of those countries were enabled to deposit their trade-marks in our Patent Office.

Under these treaties marks were also deposited in our Patent Office by citizens of the United States. This practice was disapproved by the Commissioner of Patents in a ruling made in December, 1872, in which he held that these treaties and conventions did not confer authority for our Patent Office to accept the deposit of marks by our own people.

The desire of our citizens, therefore, to enter their trade-marks with the central government appears to have been strong at an early day, when a design patent in one instance and a convention to enable foreigners to deposit their trade-marks here in another were seized upon as authority for filing trade-marks in the United States Patent Office.

Legal Notes

Sunday and Amendments.—In *ex parte* Miller Commissioner Moore has decided that where the year within which action could be taken expires on Sunday, in order to save the case from abandonment, amendment should be filed on the preceding day.

A Point in Interference Proceedings.—In Seacombe v. Burks, Assistant Commissioner Billings has held that the question of a party's right to make claims corresponding to the issue of an interference does not depend upon whether an amendment is subsequently made. The sole question to be considered is whether the specificaton and drawing of the application are sufficient to justify the allowance of the claims in question.

The Davey Patent Sustained.—In Davey v. Cutter, 197 Fed. Rep., 178, the Davey patent, No. 890,968, for a process of treating and dressing a bruise or wound in a trunk or branch of a live tree was held valid and infringed. In the patented process a cavity is formed in the tree by removing all decayed, unsound and foreign matter, and the walls of the cavity are then coated with molten tar and before the tar hardens the cavity is filled with cementitious material which will adhere to the tar.

A Suit Thirty-six Years Old.—A suit is now before the Supreme Court and will probably be heard in October, which was begun in or about May 17th, 1876, in the Circuit Court of the United States for the Southern District of New York. The suit involved title to a number of Edison patents and the parties to the original bill were George Harrington, described as of Washington, D. C., and Thomas A. Edison, plaintiffs, and the Atlantic & Pacific Telegraph Company and Jay Gould, defendants. Testimony was taken in New York and London during 1879 and 1880, and in 1895 Thomas A. Edison, as surviving plaintiff, filed a petition in the case asking for a decree of revivor as against the executor and trustees of Jay Gould. Following the answer by the executor and trustees considerable testimony was taken and the case was heard. After various proceedings, appeals have been filed to the Supreme Court and the hearing soon to be had will be upon motions asking the dismissal of the appeals on the ground that the Court is without jurisdiction to pass upon questions sought to be raised. The prominence of the parties and the length of time consumed in the litigation give it a special interest.

Notes for Inventors

Ship-coaling Apparatus.—The apparatus shown in the patent to Michael S. Iverson of New York city shows a conveyer which is pivotally suspended at one end below a ship's deck so the conveyer can swing horizontally under the deck, a traveler supporting the swinging end of the conveyer so it can be adjusted under the deck and means being provided for adjusting the track for said carriage. The patent is No. 1,038,588.

A Conveyer with a Side Guard.—The gravity conveyer patented by John William Anderson, Jr., of Woodland, Ill., No. 1,038,514, has a bed consisting of a number of rollers side by side. Some, but not all, of the rollers are provided with means for preventing the lateral movement of the article conveyed, such means being shown as flanges on the ends of the alternate rollers and projecting across the space between the flanged rollers and the adjacent ones.

How About a Box Spring Improvement?—If you have ever slept on a good box spring you know what luxury is. The writer's experience, however, has shown that the box spring does not endure. He has been unable to find a reputable maker who would guarantee such a spring for any length of time. Ordinary bed springs last for years. The problem of a durable box spring should be solved by some one familiar with the subject.

Preserving Cotton Bolls.—Walter W. Gayle, of Montgomery, Ala., has patented, No. 1,038,562, an unopened cotton boll incased in a coating such as paraffin, impervious to air and moisture so as to preserve the boll in its unopened state, so that the boll can be harvested green or unopened and allowed to open subsequently out of the field. When so treated the boll is not subjected to deteriorating weather conditions nor to the collection of dirt, dry leaves and other foreign matters.

A Toy Eye Mask.—Herman Gruenberger of New York city, in a patent, No. 1,037,473, shows a toy in the form of a mask consisting of a cup-shaped body of yielding material which can be sustained by itself between the brow and the cheek over the eye and has a central opening through which the pupil of the natural eye is exposed, the mask, when one is applied to each eye, changing the appearance of the wearer to a remarkable extent.

Freak Amusement Automobile.—What is called a bucking automobile is covered in a patent, No. 1,039,035, to Charles E. Desenfants, of Chicago, as assignee of Edward W. Desenfants, and has front and rear axles with wheels on the ends of the axles and having their peripheries disposed eccentric to the axis of rotation, with the wheels on the front axles revoluble independently with respect to each other, so that as the car moves over the ground it will be given an eccentric motion.

A Novel Photographing Method.—Fletcher W. Battershall of Albany, N. Y., has patented, No. 1,037,192, a method of making photographs, in the practice of which a strip of film and means to separate the convolutions of the film but to exclude light are rolled together upon a spool and the film is exposed, and then with its separating means is rewound in a camera after which the roll is removed from the camera and developed in actinic light before unwinding it after it leaves the camera.

A Continuous Powder Packer.—Tadeus Paraskovich of Vienna, Austria-Hungary, has secured a patent, No. 1,037,974, for an apparatus by which medicinal and other powders may be packed. The apparatus includes a suitable guide plate on which a continuous strip of paper is fed or advanced, a suitable quantity of powder is deposited on the strip at intervals, the free end of the strip is bent upon the powder, and after the strip has been severed to separate the powder-carrying part from the body of the strip, the side and end edges of the severed and folded paper are perforated to secure the edges together and form a closed package.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of Interest to Farmers.

WIRE FASTENER FOR METALLIC FENCE POSTS.—H. L. HARTLEY, 804 Lonsdale Bldg., Duluth, Minn. This invention has for its purpose the provision of a simple and highly efficient wire fastener for metallic fence posts whereby wire may be conveniently secured to the posts by means of staples driven into the posts, and so firmly that the accumulation of sag is prevented at any particular point.

REGULATOR FOR CHICKEN INCUBATORS.—G. H. LEE, 1115 Harney St., Omaha, Neb. This inventor provides means whereby the percentage of moisture is varied proportionate to the variation of heat within the incubating chamber; and provides for changing the relative radius of alternation of dry heat and moisture in the said chamber.

STALK PULLER.—C. R. SMITH, Perris, Cal. The invention provides improvements that relate mainly to the gripping jaws for seizing stalks, the links carrying these jaws and formed into chains, the means for guiding, supporting and adjusting these chains, and mechanism for preventing the entrance of stalks, dirt, or other undesirable material into the spaces between the links of the same chain.

Of General Interest.

BRUSH BACK BLANK.—F. ZIELINSKI, care of S. Sokal, 14 Southampton Bldg., 55 Chancery Lane, London, England. The subject of this invention is an improved method of fixing bristles in stocks, more especially stocks made of cast or stamped aluminium, which has the advantage over the method at present in use that the bundles or tufts of bristles need not be glued, sewn, pressed or jammed into sockets or other holders.

NON-REFILLABLE BOTTLE STOPPER.—E. MAYOLINI DE VALDES, 131 E. 82d St., Manhattan, N. Y., N. Y. This improvement has for an object the provision of improved means arranged in a removable tube which will act as a stopper for normally closing the bottle, but permitting the free flowing of liquid therefrom, and resisting any refilling of the bottle.

STOPPER FOR BOTTLES.—W. J. WARNER, 217 E. 81st St., Manhattan, N. Y., N. Y., and A. FEILER, New York, N. Y. This invention provides a valve construction designed to resist refilling of the bottle and causing measured quantities to be dispensed, this construction being associated with a plug device to permit fluid to freely pass, but to resist the passage of any mechanical instrument.

HOLDER FOR A PAPER OF PINS.—G. GIUGLIANO, 520 Symes St., West Hoboken, N. J. This inventor provides a holder for use in holding a paper of pins and arranged to display a single row of pins at a time and in such a manner that the individual pins of the displayed row of pins can be readily removed by the user whenever desire.

PHOTO-EXPOSURE METER.—S. PRATT, 35 Highland Ave., Oakland, Cal. This invention exposes successively any number of light screens between the object and the eye, until the proper degree of obscuring is obtained, the interposition of these screens being in synchronism with the movement of a pointer, running along a pre-calculated scale, the times of exposure being readily read off on this scale for different degrees of illumination of the object to be photographed, and for different apertures.

Hardware and Tools.

FASTENING DEVICE.—M. S. FULLER, care of A. L. Kellogg, Oneonta, N. Y. The body of this device has a slot formed in one extremity thereof and having a guiding projection formed adjacent the slot, so that the end of the cord to be fastened can first be passed around the projection and then back into the slot at the extremity of the fastening device, to have a wedging engagement therewith.

MITERING DEVICE.—F. N. RUSSELL and E. CLARK, 6009 Madison Ave., Chicago, Ill. This invention is a mitering device, and comprises a plurality of saw guides, together with improved means for adjusting the said guides according to the requirements of actual practice; and means for holding said saw guides in any adjusted position.

CUTTING DEVICE.—R. W. JOLLY, 264 W. 127th St., Manhattan, N. Y., N. Y. An object here is to utilize a blade similar to the common safety-razor blade, with means for normally protecting the sharpened edge thereof, adapted to be slipped to one side to expose a portion of the blade, whereby this portion may be used as a sharpener, eraser, or the like.

GUIDE FOR KEYHOLES.—L. B. HOWARD, P. O. Box 394, Los Angeles, Cal. This invention pertains to a device to be used on an escutcheon, lock-plate, or the like, and act as a guide for the key in entering the keyhole. An object is to provide a concavely-faced member surrounding the keyhole, which will serve as an inclined guide, acting to direct the key, from any direction, to the keyhole opening.

HOSE COUPLING.—C. PARSONS, 429 Superior Ave., N. E., Cleveland, Ohio. This

coupling is especially adapted for connecting the supply pipe to the tube in such machines as riveting hammers, drills, reamers, clippers and other machines utilizing compressed air as a motive fluid, wherein means is provided for making a connection without the necessity of tools and without requiring skilled labor, which will obviate the danger of blow-out and the like.

Heating and Lighting.

HEATING AND VENTILATING APPARATUS.—C. W. EDGAR, 231 So. Ave., 66, Los Angeles, Cal. An object of the present invention is to provide a device having the form and appearance of an ordinary grate which may be used for heating air which is subsequently discharged into the room containing the grate, or which may be supplied to other rooms for heating them.

ACETYLENE LAMP.—J. M. HIGGINS, Caseyville, Ill. The inventor provides a lamp which may be easily taken apart to permit of cleaning or repairing, which will be capable of a very nice adjustment, and which will permit of an economical use of carbid, while affording a high degree of illuminating power.

Household Utilities.

SCREEN-WIRE CLOTH.—H. F. JACKSON, 619 E. New York St., Indianapolis, Ind. This invention provides a cloth for use on door and window screens or to cover openings of buildings to keep out flies, mosquitoes and other insects, the cloth being reinforced in process of manufacture to render it exceedingly strong and durable without duly increasing the weight, and provides means for fastening the marginal edge of the cloth to the screen frame.

CLOTHES LINE SUPPORT.—M. RUTH, 89 Wegman Place, Jersey City, N. J. This invention comprises a compact attachment that can be easily mounted upon the side of a house adjacent a window thereof, and by means of which the clothes line can be readily and conveniently operated to enable the wash to be hung out to be dried and taken in after drying.

Machines and Mechanical Devices.

PHOTOGRAPIC PRINTING MACHINE.—R. R. LOVING, Center, Shelby Co., Tex. This machine is arranged to permit of accurately placing the negative (glass plate or film) in fixed position to print from, and to allow accurate positioning of the printing paper and bringing the same in printing contact with the negative.

WHEEL-RIM EQUALIZING AND TRUING MACHINE.—G. A. ENSIGN, care of Defiance Machine Works, Defiance, Ohio. This invention relates to woodworking machines, and provides a machine more especially designed for reducing half rims or fellies to circular shape and accurately cutting off the ends of the half rims or fellies to produce half rims or fellies of true semicircular shape, thus eliminating subsequent sawing of the joint when placing the rims on the spokes.

PORTABLE WELL BORING AND DRILLING MACHINE.—H. H. HAIGHT, 935 W. 3d St., Waterloo, Iowa. This inventor provides an operating platform for a machine portable and operable upon its carrying wheels; provides a mechanism mounted upon a rotary platform, whose rotation is concentric with the center of operation of the well; provides an operating mechanism driven from a stationary member with which the operating mechanism is operatively connected; provides means wherein the speed of the hoisting drum is variable; provides a balancing fly wheel connected to the driving shaft by a dragging connection to relieve shock of sudden engagement between shaft and wheel, and to permit rapid initial acceleration of speed on the driving shaft.

DEVELOPING APPARATUS.—S. PRATT, 35 Highland Ave., Oakland, Cal. This apparatus develops and washes sensitized films in such a manner that they will at no time be exposed to the light. An object of the invention is to supply the developing apparatus with adjustments whereby it may be adapted to accommodate films of different sizes.

CLUTCH.—H. B. SAVAGE, Cedar St. and Scioto Ave., Spokane, Wash. This improvement is in clutches in which an expansible ring is arranged within a cylindrical rim and adapted when expanded to firmly engage and lock with the same by friction. It is common to fasten such expansible rings in a way that the ring does not take a friction hold on the rim at all points. Mr. Savage overcomes this objection by providing means by which the ring engages the rim equally at all points.

OIL FEEDING DEVICE.—C. F. HOOFER, 324 Chemical Block, Spokane, Wash. An object here is to provide a device in which the feeding of the oil is accomplished by pneumatic means. A further purpose of the invention is to provide a device by means of which the flow of oil may be regulated to any degree, within limits.

STEAM TRAP.—J. D. WESTCOTT, Union City, Pa. In this trap the valve stem has free movement in a tube moving with the valve stem, and to which a float is secured, the tube engaging a lever at the top of the trap, which operates through a rod, the lower lever engaging the member secured to the valve stem to raise the valve. The levers insure opening of the valve which the float alone will not do when the valve is closed while under pressure.

FEED MECHANISM OF TURNING MILLS, LATHES, OR LIKE MACHINES.—A. E. BENNETT and H. THOMSON, care of Marks & Clerk, Coventry, England. This invention is primarily intended for use in turning machines, and is particularly adapted to suit what are now known as boring and turning mills, which are of the lathe type placed in a vertical direction, but may also be adapted to an ordinary lathe or similar machine having two directions of feed, the one at or about right angles to the other.

WHEEL BORING AND FACING MACHINE.—G. A. ENSIGN, care of Defiance Machine Works, Defiance, Ohio. This invention relates to wood-working machines and its object is to provide a new and improved machine more especially designed for boring and facing automobile wheels and similar wheels in such a manner that the boring and facing is absolutely true relative to the wheel rim, thus insuring the formation of a true wheel.

Railways and Their Accessories.

RAIL.—H. COLLINS, Fairlawn, Newport, R. I. The invention provides a rail arranged to permit convenient removal of a worn out rail head and its replacing by a new one without disturbing the position of the remainder of the rail on the ties and without requiring tearing up of all the pavement flanking the rail, thus saving considerable expense in rails and time and labor in replacing worn out heads by new ones.

Pertaining to Recreation.

TOY.—P. B. TYLER, Butterfield, Minn. This invention provides a toy controlled to vary the path of travel thereof, the variation being a matter of skill, whereby the article is aimed at a target; and provides for determining the path of an automobile toy to cause the same to impinge upon, or glide with, articles disposed in the path thereof.

MEANS FOR INDICATING THE STRIKING FORCE OF GOLF CLUBS OR SIMILAR INSTRUMENTS.—S. O. H. COLLINS and H. V. PEARCE, care of Marks & Clerk, London, England. The object of this invention is to produce an indicating device by which an indication may be obtained not only of the force of the blow, but also of its approximate directness or the point of contact of the ball upon the striking face of the club.

Pertaining to Vehicles.

BOOT HOLDER.—W. D. GILBERT, care of A. C. Haughton, 120 W. Main St., Johnstown, N. Y. The object here is to provide an inexpensive device for holding a boot in place over a puncture or the like in a pneumatic tire, which will hold the boot firmly and tightly throughout its length, and which may be easily applied and detached.

HORSE HITCHING DEVICE.—G. K. F. JACK, The Rockland, Tremont, Denver. This invention provides a device for a horse, or horses, operable by the vehicle when pulled in a forward direction and arranged to release the pulling strain when the vehicle is moved rearward; provides locking means for the wheels of a vehicle; and provides a harness attachment whereby the wheel of the vehicle may be limited in its action to exert restraint upon the driving reins of the team attached to the vehicle.

BUGGY OR WAGON GREASER.—W. T. MADDOX, Alexandria, La. The invention has for its object the provision of a simple, inexpensive, easily operated device consisting of but few parts, capable of being stored in compact form, and wherein a variety of adjustments is possible.

Designs.

DESIGN FOR A COMBINED RAZOR STROP AND MIRROR.—S. RIEGER, 38 Varet St., Brooklyn, N. Y. This design is mainly of the usual shape, but the ring end and the handle end of the strop comprise original ornamental forms, the former end square, the latter end round and both holding mirrors.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Aviation at the French Maneuvers

(Concluded from page 330.)

and visited the field at Villacoublay at 6:30 A. M., and was piloted around the field by Colonel Hirschauer, permanent inspector of military aeronautics. M. Millerand reviewed ten regular escadrilles and five reserve escadrilles, containing in all seventy-two aeroplanes. The aeroplanes were all lined up on one side of this splendid field and presented a wonderful spectacle. After M. Millerand had completed his review and made a congratulatory speech, the aeroplanes were started in groups of from a half-dozen to a score at one time. They presented an imposing spectacle as whole flocks of these mechanical birds arose and flew home across country at high speed.

Commenting upon the results obtained at the French maneuvers, and, in fact, those obtained by all the maneuvers held by the various powers recently, including England, army men are of the consensus of opinion that the aeroplane has but one use, namely, its use in reconnoitering work as an aid to the cavalry. The idea that aeroplanes can be used for the purpose of fighting in the air, seems to be generally denied. According to a memorandum issued by the British War Office, the work of cavalry will undoubtedly be greatly aided by a well-trained aeronautical service, but except to a certain extent in long distance reconnoitering, air craft cannot in any way replace cavalry. The three uses of cavalry are given as (1) gaining information, (2) affording protection, (3) action on the battlefield. It is only to the first of these uses that the aeroplane can properly be put. The three kinds of reconnoissance of which the aeroplane is capable are classified as follows: strategical reconnoisance, tactical reconnoisance, and the service of intercommunication. A modern aeroplane with a well-trained pilot can fly out a distance of 70 miles, reconnoiter the country thereabout, and return, within about four hours time, and be able to report the approximate strength, formation, and direction of movement of the enemy. But, as the value of the information depends to a great extent on the time which has elapsed since the events occurred which are being reported, it is highly important to have the aeroplane equipped with wireless and to be able to send back immediately reports of what is found. This is also true in the case of tactical reconnoissance, which is reconnoissance at short distance, when the cavalry is within close touch of the enemy's cavalry and can no longer advance. And in the service of intercommunication, the wireless is again brought into play to supplement the field telegraph and telephone services that are now so widely used. In other words, in reconnoissance work it has been found advantageous to supplement the work of the cavalry on the ground by aerial reconnoissance by means of air craft. France is the first country to work out the theory and practice of aerial reconnoissance. In the recent maneuvers the aerial corps was thoroughly organized and used as an aid to the cavalry. The nearly two-score machines in use were kept in operation so much of the time that in the two weeks of the maneuvers a distance of 42,000 miles was covered in flight. In numerous instances aviators flew from 500 to 700 miles a day, during the maneuvers.

The kind of machine to be used for various purposes has now been practically agreed upon by all the foreign powers, although France, of course, was the first to determine the various kinds of machines for different uses. These are as follows: For the cavalry, one-man machines that are rapid and light, as well as speedy, monoplanes being the principal ones used for this purpose. For the artillery, where observation is everything, two and three-seated machines are preferable. As slow speed is best for this purpose, biplanes are generally used. For long trips for strategic reconnoissance such as is necessary in the case of a siege and where the observations must be made over a long period of time, dirigibles are

preferable; and finally, for practical reconnoissance, where the results must be immediately obtained, two-seated machines, either biplanes or monoplanes, are by all odds the best, as in such machines the pilot can be accompanied by an officer or a soldier who acts as an observer. It is preferable to have the observer a pilot as well, and to have the machine fitted with a duplicate control, so that in case of accident to the pilot, his observer may fly the machine and bring it safely to earth. In actual warfare, where there is danger of being hit by bullets, this is all the more necessary.

One very important point with regard to the military use of aeroplanes is the fact that in bad weather they can not operate. Fog, snow, heavy rain, or violent wind make it impossible for the aeroplane scout to do his work, and in the recent German maneuvers, during two days out of five, no flying was possible. On the other hand, after waiting for suitable weather, a fast monoplane can cover as much territory in a few hours as would require several days for a troop of cavalry to thoroughly explore, and aerial scouting has the further advantage that reports can be instantly transmitted by wireless.

Money That Really Talks

THE question of protection against counterfeit banknotes is one which is being discussed in England just at present. A member of the Royal Society recently showed the results of a discovery which he made, and by this means he is able to imitate copper or steel-engraved bank notes so perfectly that the president of a large bank was unable to pick out the single genuine banknote out of a lot of ten which included nine of the kind reproduced by the author. This was intended to show the error of the prevailing opinion that banknotes cannot be imitated. At the same time that this somewhat disconcerting news comes out, a new remedy against counterfeit notes is proposed, this being the "speaking" banknote, and should a system of the kind be adopted, the note will not only concern the eye, but will assert its genuineness in a loud and intelligible voice, should it be placed in a phonograph. In fact, the note carries a given phrase which is inscribed on the edge just as on a phonograph cylinder, using a specially prepared paper for this purpose. Any kind of phrase can naturally be used, and its purport is of little importance, as it is designed simply to have a check upon the quality of the banknote by the use of the voice. All that is needed is to put the note into a properly-designed phonograph, when it will speak for itself, according to the present idea, while a counterfeit remains silent. The method is certainly an original one, but it would not seem a very hard matter to counterfeit the phonograph record as well as the note itself.

Electrical Energy for Reclaiming a River Bank

IN interesting contrast with the great hydro-electric generating transmission systems of which so much is heard nowadays, including schemes to utilize the water power of the great rivers of the country, an electrically driven plant for making a new river front at East St. Louis, Ill., is now in operation. With this equipment six million cubic yards of material are being dredged from the bed of the Mississippi River and deposited to transform a two-mile front of lowland, elevating the land to a level well above the high-water mark of the river. It is purposed to complete this undertaking within the next two years. The dredge performing this engineering work, equipped with special machinery for loosening the silt of the river bottom and then pumping it back a considerable distance to the "fill," is supplied with energy over a 2-mile, 13,200-volt transmission line, and has been in successful operation since August 15th. The main pump is of 1,000 horsepower and is capable of delivering about 500 cubic yards of solid material (constituting 15 to 20 per cent of the total fluid discharge) per hour.

NEW BOOKS, ETC.

HANDBUCH FÜR HEER UND FLOTTE. Enzyklopädie der Kriegswissenschaften und verwandter Gebiete. Herausgegeben von Georg von Alten, Generalleutnant z. D. Unter Mitwirkung von mehr als 200 der bedeutendsten Fachautoritäten. Vollständig in 108 Lieferungen reichillustrierten Textes mit farbigen Beilagen, Karten, Plänen, Gefechtsskizzen usw. Deutsches Verlagshaus Bong & Co.

The wars of the middle ages are most elaborately discussed in the 38th to the 40th installments of this Army and Navy Hand Book. First of all, Dr. Walter Mehl gives a very clear account of the early art of warfare, with a very interesting analysis of the East German colonization movement of 1789 to 1843. By far the most important division of the subject of medieval warfare has been assigned to the editor of this particular volume, Dr. Francis Smith, a pupil of Delbrueck's. The very complicated wars of the medieval Italian states, complicated because they were so involved with political dissensions, he has discussed with admirable clearness. Wars in other countries are also taken up. Of the sixty-nine maps showing battlefields, contained in Volume IXa, Nos. 7a to 21 are to be found in the three installments before us. Since they contain all the geographical names referred to in the text, they constitute an invaluable aid in studying the great wars of the middle ages. Particularly interesting are the maps accompanying the discussion of the Arabian wars (622 to 1071), showing the remarkable expansion of Arabic sovereignty over three-fourths of the then known earth.

BATTLESHIPS OF THE UNITED STATES NAVY. From Photographs by E. Muller, Jr., Photographer United States Navy. Introduction by George von L. Meyer, Secretary of the Navy. New York: E. Muller, Jr. Price, 50 cents.

This excellent work is based upon several years' service by the author as official photographer to the United States Navy. It opens with a portrait of the Secretary of the Navy and a short introduction. Then follows a page explaining, in a graphic way, the difficulties under which photographs of ships in action are obtained. The majority of the photographs are 6½ by 9½ inches, and the one hundred or so pages are almost entirely filled with excellent reproductions of the ships of the navy. The book contains a good half-tone of every important battleship and armored cruiser, all of these being 6½ by 9½ inches. Then follows a remarkable series of photographs of gun practice, taken during the spring and autumn target practice. Some of these are already familiar to the public. Others are entirely new and were taken at the last maneuvers. The book also contains views of the life of the seamen and officers in detail, and in addition to target practice it includes views of torpedo practice, mine laying, and the various sports and pastimes which render life at sea attractive to the enlisted man. Of special interest will be some of the latest photographs taken at the moment of discharge of the big guns at the recent gun practice.

TEXT BOOK ON THE STRENGTH OF MATERIALS. By S. E. Slocum, B.E., Ph.D., and E. L. Hancock, M.S. New York: Ginn & Co., 1911. 8vo.; 372 pp.; illustrated. Price, $3.

In constructional work of all kinds a knowledge of the strength of materials is an important factor of efficiency, durability, and safety. Advantage has been taken of the opportunity afforded by this new edition to correct the few inevitable errors of the first, to amplify where necessary, simplify wherever possible, and to add such practical knowledge and material as the past five years have developed. The metals, mixtures, brick, stone, timber, rope, wire, and belting are all specifically considered, in addition to the general properties of materials and their behavior under stress and strain, with analyses of forces and practical formulæ. Part I.—the analytical treatment—is the work of Prof. Slocum, while the responsibility for Part II, the experimental or laboratory aspect of the subject, is assumed by Prof. Hancock. The aim has been to present the material so that it shall contain no insuperable difficulties for the technical student of junior grade.

THE STEAM TURBINE. The Rede Lecture, 1911. By Sir Charles A. Parsons, K.C.B. Cambridge: At the University Press, 1911. New York: G. P. Putnam's Sons. 12mo.; 57 pp.; illustrated.

It goes without saying that any lecture Sir Charles may give on the subject of the steam turbine is informative and well worth our time and attention. In this, its printed form, the lecture is enhanced by illustrations from *Engineering* and other sources. The author dwells upon the fact that the initial experiments in the case of the steam turbine were commenced on the strength of data furnished by physicists, which encouraged the belief that a successful engine of this nature was merely a matter of practical perseverance. More than a hundred thousand dollars was spent before an order was received. More recently an additional hundred thousand was expended in the effort to prove the advantages of mechanical gearing of turbines in marine work, and the success of this venture is set forth in a narrative of the accomplishments of the "Vespasian." The first Parsons turbine is the subject of a full-page illustration, and succeeding engravings show the parts and operations which go to the completion of a marine steam turbine. The Curtis multiple impulse, compounded type is explained, and its advantages cited. The problem of the turbine in its relations to economy and speed is propounded at some length, with a consideration of its value in war vessels and in the merchant service.

THE AUTOBIOGRAPHY OF JOHN FRITZ. New York: John Wiley & Sons, 1912. 8vo.; 327 pp.; illustrated. Price, $2.

This autobiography is the plain story of a plain, shrewd man who, with little aid from early education, fought his way to the front by sheer native pluck, ingenuity, and perseverance. The son of a German farmer, John Fritz became one of the little army of pioneer workers who "laid the foundation and started the building of the greatest industrial empire the world has ever known." His activities in connection with the iron and steel industry, the Bessemer process, the acid and basic open-hearth, and the electric furnace, justly brought him commendation and honors from the colleges and distinguished engineering societies of this country and England. Those whose interests lie with iron and steel will read the autobiography as a simple but none the less truthful and charming delineation of certain phases of the industry. Those who may not fully appreciate the technical difficulties met and overcome yet must feel the uplift of the dominant chord of the work, the triumph of grit and integrity over almost insurmountable obstacles, while experience, shaped by will, in turn shapes and molds the life until it crystallizes as character.

THE RAILWAY SIGNAL DICTIONARY. An Illustrated Vocabulary of Terms which Designate American Railway Signals, their Parts, Attachments and Details of Construction, with Descriptions of Methods of Operation and some illustrations of British Signals and Practice. New York: *Railway Age Gazette*, 1911. 4to.; 526 pp. Price, cloth, $3.50; full morocco, $6.

The title "Dictionary" does scant justice to the work, for it is in great measure a cyclopedia of the subjects it embraces, an illustrated catalogue, and a text-book or manual, all in one. Its information, compiled by the *Railroad Gazette* under sanction of the Railway Signal Association, is the more authoritative for having been supervised by a committee of the association. The first edition was issued in 1908, but developments in railroad signaling during the period 1908 to 1911 have been twice as extensive and important as in any previous period of equal length. Hence, the necessity of a revised edition that, while recognizing apparatus likely still to remain in extensive use for some time although no longer made, yet features the latest equipment. An historical sketch traces the adoption and progress of the block system on American railways. Tables show the extent of its use in the United States on January 1st, 1911. Then follows the dictionary proper, defining words, terms, and phrases used in signaling, and referring by page and figure numbers to the section of illustration and description. The remainder of the work consists of profuse illustration of every conceivable symbol, signal, and accessory, with descriptive text. Block signals, manual, controlled manual, and automatic, are fully and admirably treated, as are also interlocking systems and the multitudinous accessories. It will be understood that the work does not include hand-motion signaling, but deals only with fixed signals and with such equipment as automatic bells at highway crossings which, while it may not directly affect the movement of trains, yet comes directly under the attention and charge of the signal engineer. The dictionary should become an indispensable adjunct of the railroad reference library.

MARINE STEAM TURBINES. (Forming the Supplementary Volume to Marine Engines and Boilers.) By Dr. G. Bauer and O. Lasche. New York: Norman W. Henley Publishing Company, 1911. 214 pp.; illustrated. Price, $3.50.

Although the authors of this book are engineers in the employ of a great German electrical company, by whom a modified type of Curtis turbine is made, their book discusses the well-known Parsons type as well. Of the volume's practical value there can be no doubt. The authors are men who have been engaged in the actual building of turbines, and their formulæ and directions are the result of a practical experience which it is difficult to acquire and frequently still more difficult to present in a book of this character. The task which they have set themselves has been accomplished admirably. The translation by Mr. M. G. S. Swallow is good. Moreover, he has done what few translators are capable of doing, that is, he has supplied an illuminating foot note here and there and a few critical remarks, that undoubtedly add much to the value of the work. The contents of the book are as follows: General Remarks on the Design of Turbine Installation; Calculation of Steam Turbines; Turbine Design; Shafting and Propellers; Condensing Plant; Arrangement of Turbines; General Remarks on the Arrangement of Steam Turbines in Steamers; Turbine-driven Auxiliaries; Tables.

JAHRBUCH DER SCHIFFBAUTECHNISCHEN GESELLSCHAFT. Vol. XIII. Berlin: Julius Springer. Price, 40 marks.

This year's volume of the Jahrbuch we find devoted very largely to internal combustion engines and problems of the propeller. Prof. Flamm contributes an interesting paper on "Aims of the Scientific Study of Naval Architecture in Germany," and Prof. Schlick one on "Vibrations of Steamships." These papers, however, were originally prepared for the Institution of Naval Architects of England.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12689) A. E. S. asks: Surfaces may appear to the eye to be in contact when they are not actually so. Even a convex lens leveled on a flat object does not touch it, and cannot be made to do so, even by a force of many pounds. Now, how much weight or pressure would it be necessary to make the objects touch? Can two objects be brought in absolute contact without uniting? Would a pressure of say 500 pounds still leave an intervening space between the objects? To be clear, at any pressure when two flat, hard objects do not unite, that is do not cohere, is there always an intervening space between said objects? A. We think it may be laid down as a safe criterion that when one surface is scratched by another, the two must have come into contact. We have many times had lenses scratched and marred by laying them down on a flat surface. We wish we could apply your statement to them and make the lenses believe that they had not touched the surface below them. It is our firm belief, though open to co viction upon proof, that surfaces do come into ontact with very little pressure. In Prof. Sprin 's experiments at Liege, two bars of platinum were turned true and polished. When one was placed upon the other, they cohered and became one bar. A bar of copper placed upon a bar of zinc became one, and a yellow line of brass was seen where they united. No pressure was used beyond the weight of the upper bar, and the temperature was far below the melting point of the metals. You will find Prof Spring's experiments in our SUPPLEMENT, 1305, which we will send you for 10 cents. Two surfaces can be brought into absolute contact without uniting. Prof. Spring brought non-plastic substances together, and could not make them cohere with any pressure he could bring to bear upon them, as is shown in the same article referred to above.

(12690) J. F. writes: In two very interesting articles in recent issues of the SCIENTIFIC AMERICAN, dealing with the flight of projectiles, many valuable and interesting points of information were laid before the laity. Gravity as I have learned in physics is an unvarying force. I was taught, and from experiments I conducted believe, that when two bodies spherical in form, of equal bulk, were suspended with their centers in the same plane, both would reach the earth at the same time, regardless as to whether one was merely dropped and the other projected into space on a line horizontal to the plane of the center. Evidently I have harbored a delusion these many years, for in your second article mentioned, the flight of a shell from a mortar is shown to rise in a given curve, while the curvature of descent differs. This it appears to me is in defiance of the laws of gravity, since the force of gravity acts upon the projectile with an equal force every moment of flight, both in arising and in descent. Kindly enlighten me further upon this matter, and advise me if the example I cite is in error. A. We do not think you need fear for the force of gravity because a shell from a mortar describes a different curve during its fall from that described during its rise. The resistance of the air to the motion of a body through it at a high velocity is very great, and the shell is moving much more slowly in the component of its flight, due to the powder, as it falls than it did when it left the gun. It falls much more directly toward the earth, as is shown in Fig. 8, to which you refer. The horizontal component of its motion has very nearly disappeared, because of the resistance of the air, and the shell finally plunges vertically down under the force of gravity alone. The laws demonstrated in physics for projectiles apply only to a space without a resisting medium, i. e. to a vacuum. The rise and fall of a shell from a mortar is not the equivalent of the experiment in physics of dropping one ball and shooting another horizontally. Both balls in the experiment are resisted equally in a vertical direction by the air, and both fall with an equal acceleration vertically, and hence are all the time of fall in the same horizontal plane at the same instant. A shell from a mortar, however, rises in a curve which has two components, one vertical and the other horizontal, due to the resolution of its velocity of discharge and the angle of elevation of the mortar. Its vertical component is destroyed by gravity and the shell ceases to rise. Its horizontal component is destroyed by the resistance of the air, and if the flight lasts till this is wholly destroyed, the shell would then be falling vertically point down by gravity alone, as shown in Fig. 8. It is in this respect that the actual flight of a shell differs from the theoretical path shown in the textbooks. There would be little hitting in long distance target shooting if no allowance were made for the deviations from the theoretical trajectory due to various causes. Gravity acts exactly the same, both in the rise and fall of a shell, but the resistance of the air changes with the velocity of the shell, and herein is found the explanation of the point which troubles you. It did not come within the scope of the article in question to discuss this matter at all. We hope our treatment of it has made it clear.

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without seeing the car or even a photograph

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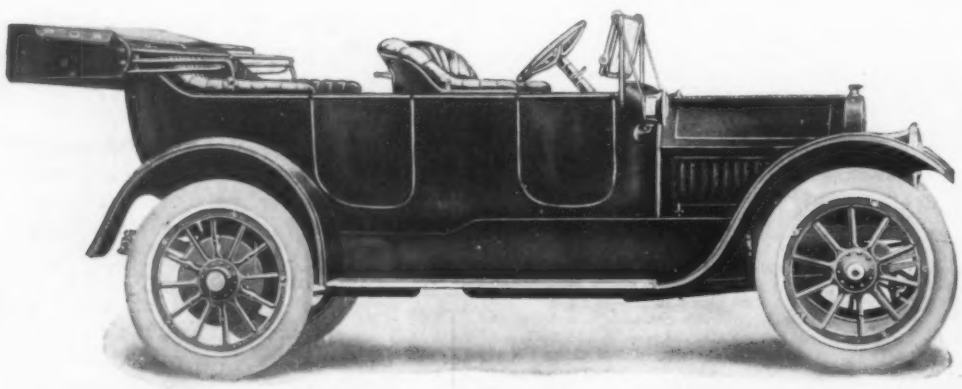
In the light of previous experience and the present eager enthusiasm, your course therefore should be clear.

Simple prudence—and simple justice to yourself and to him—suggests the wisdom of an early conference with your Cadillac dealer, even though you may not want delivery of your car for several months.



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